THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXIV. No. 582.] LONDON, JULY 7, 1874. [26TH YEAR.] Price 6d.

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Reference is kindly permitted by the Engineers of the City of London, Commercial, London, and Surrey Consumers Gas Companies, who pronounce it the best Paint known for their purposes.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints for which purpose it is superior to White Lead.

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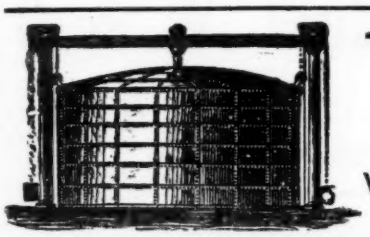

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Sole Makers of B. W. Thurston's Combined Condensing, Scrubbing, and Washing Apparatus,

AND PATENTEES OF THE IMPROVED COMBINED CONDENSING AND PURIFYING APPARATUS SO EMINENTLY ADAPTED FOR EXPORTATION.

REFERENCES TO UPWARDS OF 300 GAS-WORKS.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

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CONTRACTORS FOR GAS PURIFICATION BY OXIDE OF IRON.

The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

JOHN WILLIAM O'NEILL, SAMUEL H. JOHNSON, } Joint Managing Directors.

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GEORGE WALLER & CO.,

GAS ENGINEERS AND CONTRACTORS,

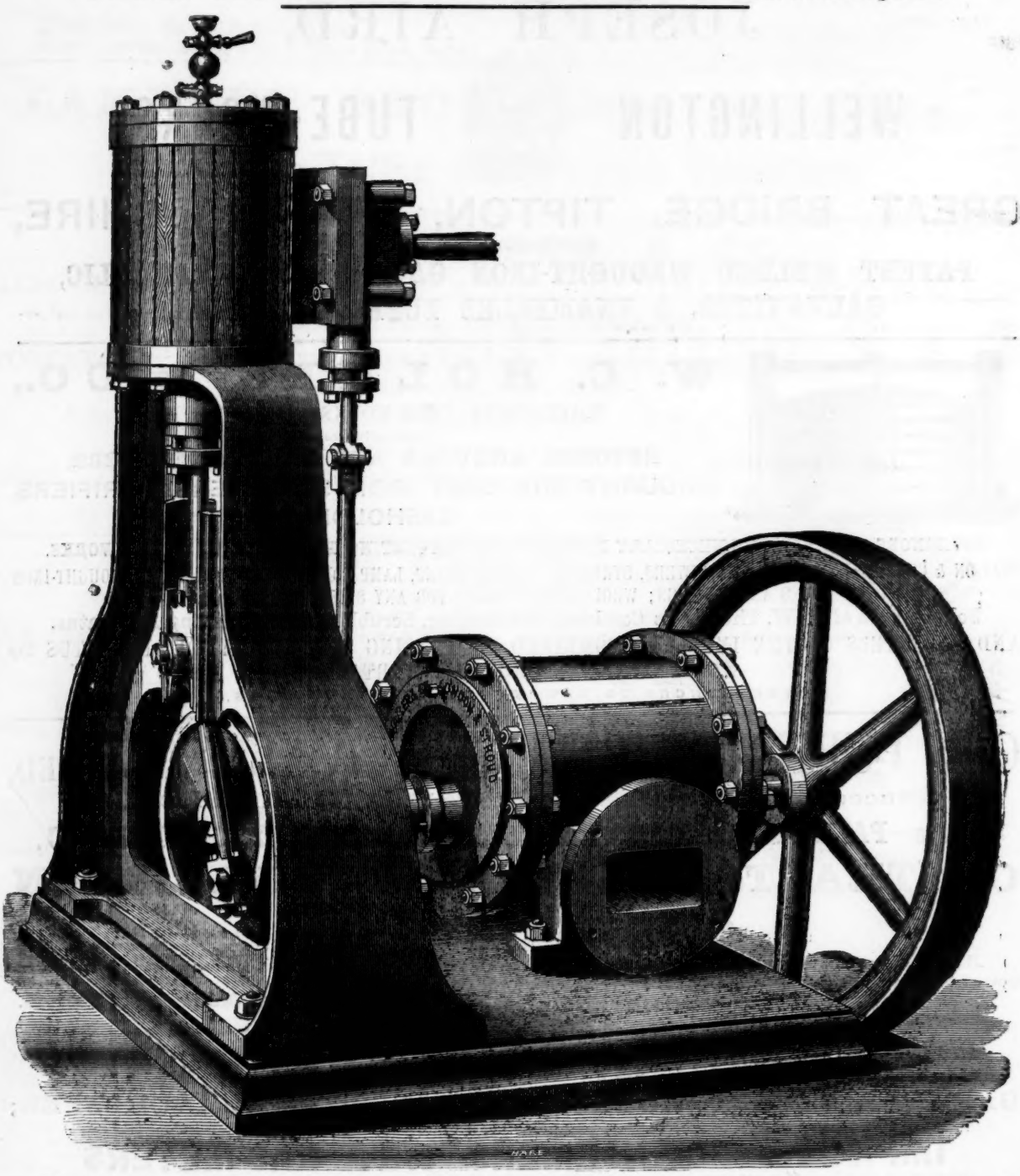
SOLE MAKERS OF

Beale's Improved

PATENT GAS-EXHAUSTERS AND COMBINED ENGINES,

ON ONE BASE PLATE.

NOTE.—The Exhausters are extra large for moderate speed.



This COMBINED VERTICAL ENGINE and EXHAUSTER was specially designed by G. WALLER AND Co. for small works, where space is an object, and is applicable for Exhausters from 1000 to 15,000 per hour. This is the *only* Engine and Exhauster **complete on one Base Plate,** requiring only one foundation.

NOTE.—They are sent away complete, and are easily fixed.

PHŒNIX ENGINEERING WORKS, HOLLAND STREET, SOUTHWARK, S.E.,

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WILLEY AND FORD,

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WORKS: COMMERCIAL ROAD, EXETER,

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EVERY DESCRIPTION OF GAS APPARATUS.

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RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

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An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

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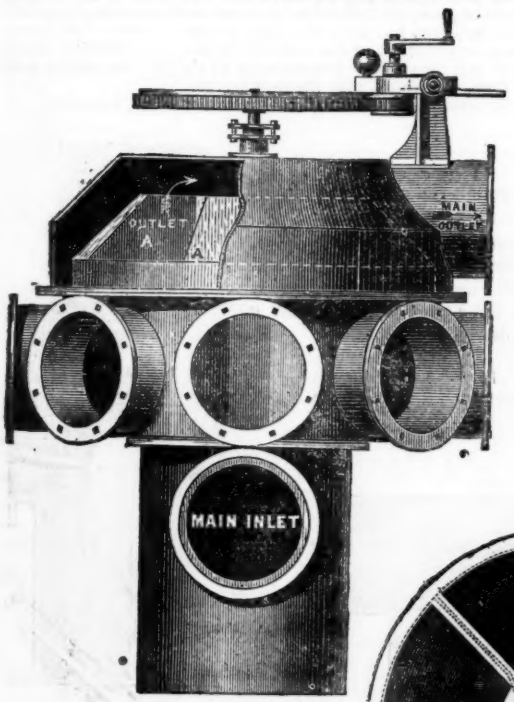
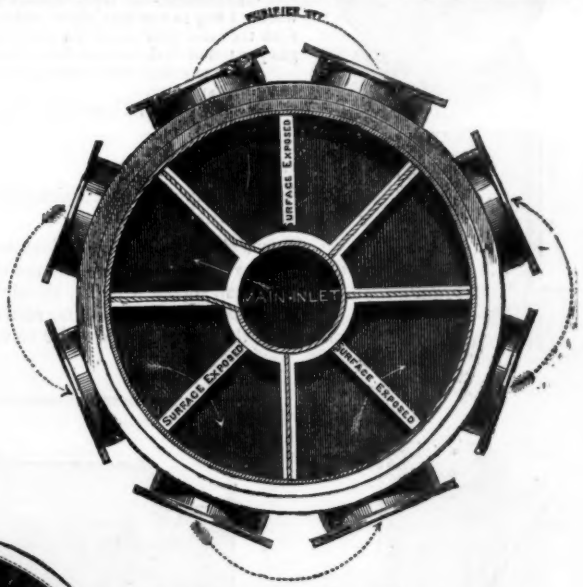
GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

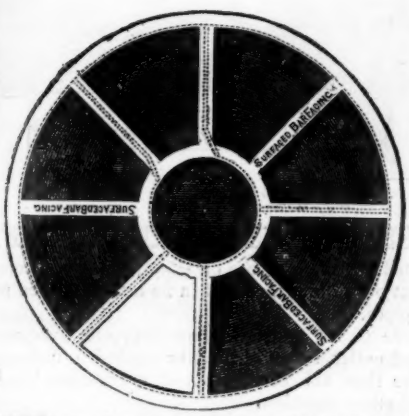
C. & W. WALKERS' PATENT CENTRE-VALVES.



Elevation of the Centre-Valve for four Purifiers. The safety cover is shown broken, to enable the Valve itself, which is inside, to be seen.



Plan of the Body, showing the Valve lying in it, with three of the facings, which were formerly exposed to settlements of dirt, carbon, naphthaline, &c., but which are now always covered by the surfaced bar-facings of the Valve. (See below.)



Plan of the Valve, or upper portion, showing the surfaced bar-facings referred to above.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A very considerable improvement and saving is effected in the cost of the connecting-pipes.

FOUR-WAY CENTRE-VALVES FORMING INLET, OUTLET, AND BYE-PASS.

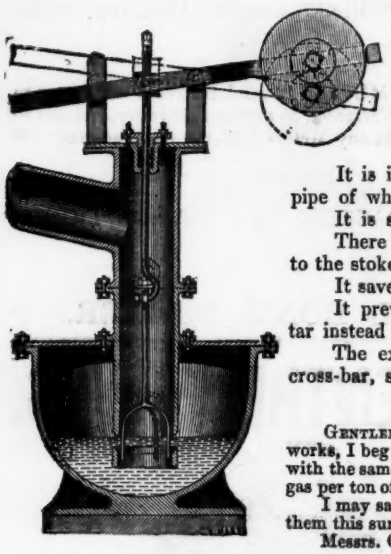
MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

CAFFALL, THOMAS, & CO., LIMITED.

PATENT IMPROVED SEAL

FOR

GAS HYDRAULIC MAINS.



It relieves the retorts from all pressure during the time gas is being made.

The end of the dip-pipe not being immersed in the tar, permits the gas to pass freely, and without pressure, from the retort into the hydraulic main.

The dip-pipe can be effectually sealed without trouble, to resist the back rush of gas, *to any possible pressure*, during the time of charging; but in the event of the Seal being left on, after the retort is closed, no inconvenience is caused, as the piece of pipe used as the Seal only lengthens it to an ordinary dip-pipe.

It is inexpensive, and can be easily and readily applied to any existing hydraulic main and dip-pipe of whatever shape or size, at a trifling cost.

It is simple in its arrangement, and cannot get out of order.

There is no deposit of carbon on the top of the retort, thereby saving considerable time and trouble to the stokers when drawing and charging, also the injury caused by scurfing the retort is avoided.

It saves 10 per cent. of the coal carbonized; also the same proportion of fuel, retorts, labour, &c.

It prevents the thickening of the tar in the hydraulic main, as the heated gas passes *over* the tar instead of being forced *through* it.

The extension piece of pipe is moved by a lever, from which hangs a $\frac{3}{8}$-inch rod, hooked on the cross-bar, so that the lid of the retort cannot be struck without first sealing the pipe.

Alton Gas and Coke Company, Alton, Hants, April 25, 1874.

GENTLEMEN,—In reply to your inquiry respecting your Patent Dip for Hydraulic Gas-Mains in use at these works, I beg to say that, upon looking into our carbonizing account for the last 12 weeks, and comparing the result with the same quarters of the past five years, I find that your Dip has given our Company an increase of 1286 feet of gas per ton of coals beyond the make in the other years, notwithstanding the retorts have been in use for three years.

I may say that our Company are so satisfied with the Dips that it is intended to fit up the other retorts with them this summer.

I am, gentlemen, your obedient servant,

Messrs. Caffall, Thomas, and Co., Limited, 28, Gracechurch Street. WM. TRIMMING, Secretary.

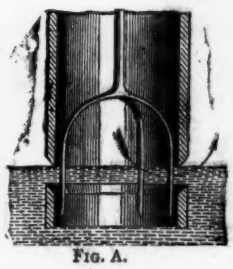


FIG. A.

Figure A shows the extension piece lowered to permit the gas to pass out of the dip-pipe without pressure.

Figure B shows the extension piece raised against the end of the dip-pipe, thereby preventing any back passage of the gas during the time of drawing and charging; and should it be left up while the gas is being made, no inconvenience is caused, *nor danger of bursting the retorts incurred; it being an open pipe and not a solid plug*, the gas will pass under as with the usual dip-pipe.

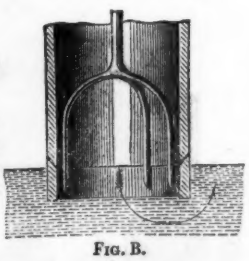


FIG. B.

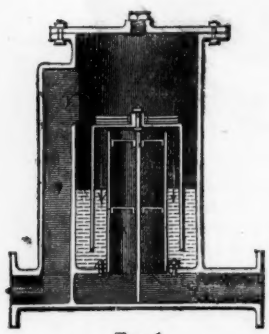


FIG. 1.

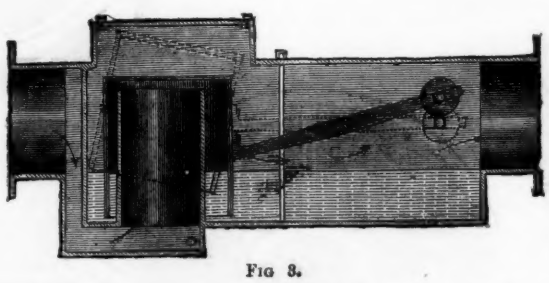


FIG 3.

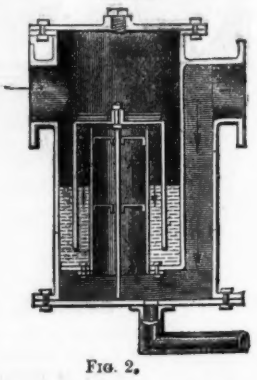


FIG. 2.

BYE-PASS FOR EXHAUSTER (Fig. 1).

This Hydraulic Bye-Pass has been invented for the purpose of supplying to gas companies a cheap, effective, and self-acting valve. It is simple in its construction, cannot get out of order, perfect in its action, can be made to stand any pressure, occupies very little space, and can be adapted to any existing pipes.

Fig. 2 is a Valve similar to Fig. 1, but made to act as a self-acting hydraulic bye-pass for washers, condensers, scrubbers, and meters; the Valve part being *below* the inlet and outlet, so that it may be applied to underground mains. Both Valves can be fitted to existing mains without disturbing them, more than the cutting out of a sufficient length to permit the fitting in of the Valve; after being properly fitted, they will require no further attention.

SELF-ACTING HYDRAULIC SAFETY-VALVE (Fig. 3),

For preventing the back flow of gas from the gasholder, and thereby preventing the possibility of accidents (the great damage and danger to life and property resulting therefrom) through the breaking of pipes, unsealing of purifiers, or any other cause. It is easy and prompt in its action, for upon the forward pressure of the gas ceasing, the bonnet *instantly* closes over the stand-pipe, thereby effectually preventing any return of the gas; no extra pressure is put upon any part of the works by its use, and it can be made to stand any required pressure.

Every information can be obtained, and Models seen, at the Offices of the Company,

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TANGYE BROTHERS AND HOLMAN,

LAURENCE POUNTNEY LANE, LONDON, E.C.,

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

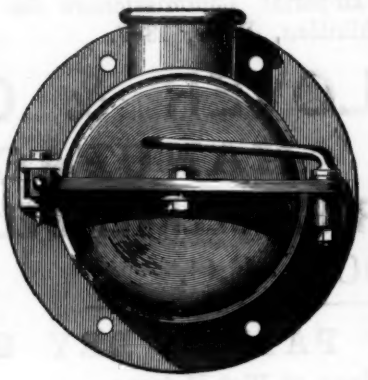
HOLMAN'S PATENT ECCENTRIC FASTENINGS & ANTI-FRICTION CATCHES.

OVER 10,000 IN USE.

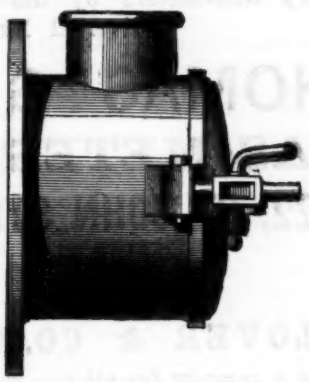
NO LUTING.

LIDS HINGED TO MOUTHPIECES; NO LIFTING ON OR OFF.

NO SCREWS FOR FASTENING.



FRONT VIEW.



SIDE VIEW.

SIMPLE.

ECONOMICAL.

DURABLE.

EFFECTIVE.

NO DUPLICATE LIDS REQUIRED.

These Lids are proved by many eminent Gas Engineers to be the most efficient, saving much time, labour, and expense; are opened and closed as quickly and with as little trouble as an ordinary furnace door, and by their use the Retorts are soundly sealed during the whole period of carbonization.

These Lids are Adopted by the following (among many other) Gas Companies:—

The Gaslight Company, Beckton (where over 2000 are in use).	The West Ham Gas Company.	The Salford Corporation Gas-Works.	The Carmarthen Gas-Works.
" Gaslight Company, Bow Common.	" Imperial Gaslight Company.	" Rochdale Corporation Gas-Works.	" Merthyr Tydfil Gas-Works.
" London Gaslight Company.	" Gas-Works, Arsenal, Woolwich.	" Liverpool United Gas-Works.	" Ystrad Gas-Works.
" Independent Gaslight Company.	" Commercial Gas Company.	" Birkenhead Gas-Works.	" St. Alban's Gas-Works.
" Phœnix Gaslight Company.	" Alliance and Dublin Gas-Works.	" Birmingham Gas-Works.	" Over Darwen Gas-Works.
" South Metropolitan Gaslight Co.	" Edinburgh Gas-Works.	" Nottingham Gas-Works.	" Aylesbury Gas-Works.
	" Manchester Corporatn. Gas-Works.	" Newcastle-on-Tyne Gas-Works.	" Cardiff Gas-Works.

The Morton's Lid is made circular in form, that being the most convenient and suitable shape. It can be used for Retorts of any section, by adapting the Mouthpiece casting from the D, oval, or other shape, at the back, to circular in front.

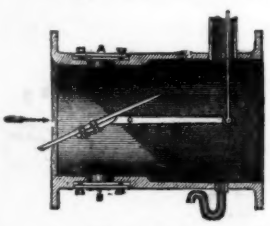
The following important Testimonial, among others, has been given:—

"*The Gaslight and Coke Company. Engineer's Office*, 6, *Westminster Chambers, Nov.* 14, 1871.

"Dear Sir,—In reply to your inquiry, I have the pleasure of stating that the whole of the Mouthpieces at Beckton have Morton's Lids attached to them, and they have given us every satisfaction. We have 2160 in use.—I remain, yours truly, (Signed) "F. J. EVANS."

SOLE MAKERS OF

HUNT'S PATENT EQUILIBRIUM GAS GOVERNOR.



In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown at C on the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

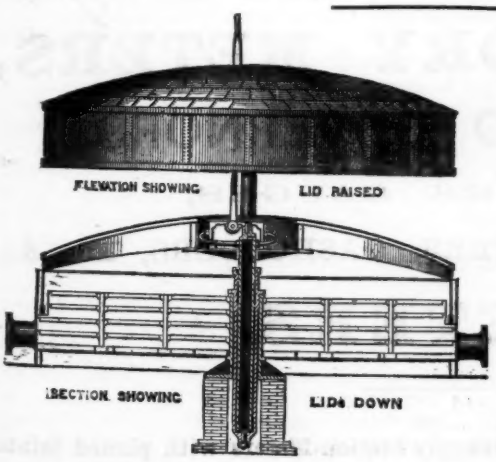
The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by several leading Gas Companies, among whom are the following:—

The Gaslight Company—a 24 in. at Whitechapel District Station.	The Gaslight Company—a 6 in. at the Gas-Works, Beckton.
" " a 36 in. at Goswell Road Station.	The London Gas Company—an 18 in. at the Gas-Works, Nine Elms.
" " a 24 in. at " "	" " an 8 in. at " "
" " a 24 in. at the Gas-Works, Beckton.	" " a 24 in. at " "

Also at the Gas-Works, Rochdale, Monmouth, Devonport, Cannes, and Mentone (France), &c.



PATENT SELF-CONTAINED

DIRECT HYDRAULIC LIFT

FOR PURIFIER LIDS

REQUIRES NO TRAVELLERS, CRANES, CHAINS, OR OTHER GEAR.

SAFE, SIMPLE, AND DURABLE.

ANY SIZE LID MAY BE RAISED BY ONE MAN.

Eight Hydraulic Lifts have been applied at Beckton Gas-Works to raise the Covers of the large Check Purifiers, which are 40 feet diameter, during the past three years, with perfect success.

London 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

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PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

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THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF

PATENT WET & DRY METERS,

STATION-METERS AND GOVERNORS,

PRESSURE REGISTERS, GAUGES,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c., &c.

WATER METERS.

W. P. & Co. beg to state that they are now prepared to supply Station-Meters with planed joints.

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THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 7, 1874.

Circular to Gas Companies.

ON commencing a new volume, the second for the present year, we may be excused referring to the success which has attended the weekly issue of the JOURNAL OF GAS LIGHTING, &c. With an extended circulation, we have been enabled to much more than fulfil the engagements made with our subscribers when the weekly publication was begun. Our promise was a 32-page number, which would have given a total of 832 pages for the half year. As a fact, however, all the numbers published this year, except two, have consisted of 36 pages, and the half-yearly volume just concluded contains 928 pages—nearly as many as any preceding yearly volume. We have thus avoided the issue of any double numbers, often required in past times, and have supplied the JOURNAL at the uniform price of 6d. We are glad to know that the change is appreciated by our subscribers, and we are encouraged to proceed in the course we have entered upon.

The case of the Colchester Gas Company, whose annual meeting we report in another column, is by no means singular. It is a very well-managed company, one of the directors having had much personal experience in the business as lessee of the works for some years. But the company can barely make both ends meet, and the directors can declare no dividend for the past year. The reason is plain. When the company obtained their special Act in 1866 they were getting coal delivered on the works at 13s. 6d. per ton, and upon that price the maximum charge for gas was determined. With some prescience they did endeavour to obtain a sliding scale of charges according to the cost of coal, but they were compelled to withdraw the provision. Last year coal cost the company 28s. 6d. per ton, and coke was a drug in the market, showing once more that this residual cannot be depended upon to make up for an increase in the price of coal. If the past winter had been long and severe, the result might have been somewhat different, but the gain to gas companies would have been got at the expense of much suffering to the poorer classes of the community. The Colchester consumers are now practically supplied with gas at cost price, and the company cannot help themselves. Their only hope, they say, is in legislative relief, which they certainly will not obtain this year, and they may, therefore, look forward pretty confidently to the prospect of no dividend next year. The shareholders of the company, probably, think that there is a course worse than "harassing every institution and trade in the country," and that is leaving them to go to ruin. But they must wait. When the licensed victuallers have been attended to, other trades may receive some consideration; and in the persuasion that it may be possible next year to obtain a hearing for gas companies, it would be well to consider beforehand what will be the best course to pursue. The idea of the Colchester Company is to apply for an amended special Act, but it is a question whether it would not be better for the companies to unite in an effort to obtain an amended general Act. Lord Carlingford's last general measure proved a conspicuous failure. It was professedly designed for the relief of gas companies, but its operation was to bind them to their misfortunes for two years. Consequently, of the many companies wanting relief, only four or five availed themselves of its provisions, and some of these to their subsequent regret. Two courses seem to suggest themselves. One is to endeavour to obtain an Act allowing a price for gas according to the cost of coal; or, what appears to find more favour just now, to go back to an old idea, and establish a sliding scale of dividend according to the price charged for gas. We fear there would be difficulties in arranging the latter plan. In the first place, the restriction to a maximum dividend of 10 per cent. ought to be removed if a sliding scale of price, in an inverse ratio to the charge for gas, were adopted; for, if not, all motive for economy and good management would vanish when the maximum dividend was obtained. We fear, however, that it would be difficult to persuade the Legislature to remove a restriction which is erroneously considered a protection to the consumer. We say erroneously, because, if a company *can* make 10 per cent., the public are certain not to get gas at a price that would yield less; and, motives for economy ceasing to operate at that point, the chances of a reduction are but small. There would be a much greater probability of a reduction if the company were allowed, in a certain event, to divide 11 or 12 per cent. It would be easier to arrange the price of gas according to the cost of coal—assuming, of course, that the price be calculated to yield the maximum dividend. The plan has been adopted in one or two recent Acts, and might well be generally extended. We sincerely hope that the Government will give serious attention to this matter during the recess, and be prepared early in the next session with a measure to relieve us from legislative restrictions which render a large amount of property in the country almost valueless.

It is one misfortune attending corporate trading that political feeling sometimes interferes, or attempts to interfere, with the management. Such seems to be the case just now at Rochdale in relation to the gas undertaking. We do not pay much attention to politics, but we gather that at Rochdale a majority of the Gas Committee are Liberals; hence violent attacks on their management by the Tory press. The committee and their manager are very well able to defend themselves, but, having looked through the accounts, and having regard to the magnitude of the undertaking, and the circumstances of the day, we feel bound to express an opinion that the management has been all that could be desired. The works have been greatly extended and improved, at a very moderate cost, and are beyond doubt in a highly efficient state. The manager's word we are certain may be depended on for the quality of the gas. It is true that the undertaking is not just now very prosperous, and never again will be so profitable to the Corporation as it has been. But that is no fault of the management. The Gas Committee can no more control the price of coal than they can compel the rain to fall. Some of our readers should study with attention the report and estimates of the committee, which we publish in another column. They have, we have no doubt, been prepared with care, and they show that on an expenditure of £28,258 for coal, the committee expect to realize only £3593 for coke. Coal for 18-candle gas in Rochdale is estimated to cost in the current year 24s. 7d. per ton. The cost looks high, considering the geographical position of the town in relation to coal-fields, but we do not suppose the Corporation could do better. We have before announced that it has been found necessary to raise the price of gas in Rochdale, which now,

allowing for discounts, averages a trifle less than 4s. 6d. per 1000 feet within the borough, which is unquestionably a low price for 18-candle gas, with coal at the price stated.

Mr. George Anderson's paper on "Purification," which we publish to-day, is a valuable and instructive contribution, which all who did not hear it read will peruse with interest. We may pass over the earlier part of the paper with an expression of perfect concurrence with the author as to the advisability of slow condensation, and the advantages of horizontal over vertical condensers, and come at once to the removal of sulphuretted hydrogen. A remarkable fact is presented to us here to which the author did not give sufficient prominence. Accepting the analyses of the foul lime from the purifiers, which Mr. Anderson gives in his letter, it is clear that more than nine-tenths of the sulphuretted hydrogen in the raw gas is taken out in the washer, and the lime, practically, only serves to remove carbonic acid. Now this is an important fact, and, if established, decides at once the question of washers *v.* scrubbers. Looking at the analyses of the Dover lime, our wonder is that Mr. Anderson ever gets a foul test at his purifiers. We are assuming that the sample analyzed represents the normal and usual composition of foul lime at the Dover works. Now, if more than a very small proportion of sulphuretted hydrogen passed the washer, it is clear that it must accumulate in one purifier or another. Chased from purifier to purifier by carbonic acid, it must be brought to bay at last, and the time must come when "it would be impossible to make clean "gas." This result, however, has never happened, and the conclusion is unavoidable that very little sulphuretted hydrogen reaches the purifiers, or, say, passes the washers. The fact stated by Mr. Anderson, in his letter, that he is now purifying the gas from 70 tons of Newcastle coal with one ton of lime, will be sufficient to direct the attention of gas companies to the matter. The avoidance of nuisance, too, is a point not to be overlooked. The lime when removed is "foul" in a different sense; it is useless for purification, but not offensive to the nose.

With regard to sulphur in other forms than sulphuretted hydrogen, we must confess that we do not quite agree with Mr. Anderson. At the same time, we do not agree with the exaggerated statements made as to the mischievous effects produced by the sulphurous acid formed when gas containing bisulphide of carbon is burned. It has indeed been suggested in these columns that the healthiness of some of our large towns may be in part due to the sulphurous acid in the atmosphere in them. Our objection is that bisulphide of carbon serves no useful purpose in gas; it is purely a diluent, and if it can be removed without trouble—and we believe it can—by all means let it be got out. It is to be regretted that Mr. Anderson did not tell us the amount of "sulphur" in Dover gas, for it is extremely probable that his washers may have an important action in removing the bisulphide. They contain precisely the material calculated to remove it. This is a point which Mr. Anderson should look into. Doctors differ; for the one or two quoted by Mr. Anderson, who believe that inhaling sulphurous acid does good, we have no doubt a dozen might be found who would declare it harmful. It is not, however, with sulphurous acid only that we have to do. An important observation has recently been made by Dr. Tichborne, of Dublin, who has found that a good deal of *sulphuric acid* is immediately produced by the combustion of gas of low illuminating power. A rich gas, he points out, produces mostly *sulphurous acid*. We may mention that, when speaking of rich and poor gas, Dr. Tichborne means the 20-candle and 16-candle gas of the Alliance Company. While on this question we may quote another paragraph from his paper, which we hope to give in full on another occasion:—

> As regards the relative therapeutical effects of sulphuric *versus* sulphurous acids, it might be said that the ultimate results would be the same, because the sulphurous acid becomes gradually converted into the higher oxide. This is only true to a very limited extent; in fact, the sulphuric acid vapours are much more local in their effects, whilst the sulphurous acid is diffused at once through the apartment, and may be perceived, by virtue of its irritating effects upon the lungs, in any part of the room. It is probable that in the storeage of delicate goods they would be much more likely to be injured by the sulphurous acid, and, *ergo*, by the 20-candle gas than from the emanations from 16-candle gas. I am of opinion, also, that there is more sulphide of carbon present in ordinary gas than is generally stated, and that it escapes all the ordinary processes of estimation.

That mischief is done by sulphur in gas we have no doubt at all. It may be the fault of the architect and the people who prefer a warm room to a draughty one; but that is nothing to gas managers, who will continue, we hope, to give their attention to the removal of an ingredient of which the least that can be said is, that it does no good in gas.

The petitions for winding up the Air Gaslight Company have been dismissed by the Vice-Chancellor, with costs. We must say that we are gratified by the decision. If air gas can be made a success, by all means let it be; if it cannot, the shareholders must pay the penalty. In any case, it will be satisfactory to see the scheme either utterly exploded or in successful operation.

Water and Sanitary Notes.

The Local Government Board have taken alarm at the prospect of a drought, and have issued a circular to local authorities, which will be found in another column. It directs the authorities within the district of a water company to call the attention of the company to the necessity of economizing the present, and, wherever necessary, providing an additional supply. This will, of course, be done wherever possible; but the Local Board will probably be the first to make an outcry if economy be practised, and additional sources of supply cannot be established on short notice.

The water supply at Hull is now fully re-established, but the pumps do not seem to have been completely repaired, so that another interruption is not at all unlikely to occur.

Loch Katrine no longer suffices for all the wants of Glasgow. The Water Committee propose to supplement the supply from the lake by another from the upper reaches of the Clyde; and an ingenious citizen recommends duplicate mains, the river water to be used for the extinction of fires, and that from the lake for domestic purposes. Complaints have been made of an insufficiency of water for the extinction of fires, which are admitted to have some foundation as regards the outskirts of the city. The citizens, however, complain that they are sacrificed for the outskirts, and altogether there seems to be a good deal of dissatisfaction with the water supply in Glasgow.

Before making a more general application of Mr. Deacon's waste meter (see J. G. L., vol. xxiii., p. 116), the Water Committee of the Corporation of Liverpool applied to Mr. Bramwell for a report as to its merits. We need hardly say that the report speaks of the meter in the most favourable terms, and praises the system adopted on Mr. Deacon's recommendation for the discovery and prevention of waste. The inventor has made a most liberal arrangement with the Corporation, who are to have the use of the meter on payment of the patent fees, £133. On presenting Mr. Bramwell's report to the committee, the chairman mentioned a case in which a leak, which had probably been in existence for years, the estimated loss of water amounting to about £278 a year, was discovered by means of this meter, and said that "the council would have no hesitation in paying the small fees, "because the committee were putting down about 300 meters in "the borough and 100 outside, and in consideration of the pay-"ment of these fees they would have the privilege of making "them themselves, thus saving £5 a meter, or £2000 altogether, "which would pay the engineer's salary, so far as the Water Com-"mittee were concerned, for five years to come. The more he "saw of the facts, the more he was convinced that the saving to "the Corporation would not be less than £20,000 a year." Mr. Deacon gets nothing for the use of his meter in Liverpool, but we hope he will be rewarded by the extensive adoption of it elsewhere. We are inclined to think that the use of it in Glasgow would be advantageous to the Corporation of that city.

Rotherham is distressingly short of water just now. That town and Masborough, it seems, get a short supply on alternate days, and the wants of the district have now become so great that the Town Council of Rotherham have resolved to apply to the Sheffield Water Company for a supply. A deputation appeared before the council at the last meeting, and asked for a supply of water, for *one hour a day*, to a stand-pipe they had put up at their own expense. Their request could not be granted; the present force, it was said, was not sufficiently strong to send water to their houses. The deputation stated that some of them had been without water from the ordinary source for three weeks, and what they had obtained they had had to bring in buckets from a place a considerable distance away from the neighbourhood in which they lived. The circular of the Local Government Board is not inopportune.

That somewhat eccentric and uncertain body, the Common Council of the City of London, have passed a resolution which, if it be not rescinded at a future meeting, pledges the Corporation to the erection of a new vegetable market on the vacant ground adjoining the new Meat Market. The site is in every respect a desirable one for the purpose, and we have no doubt at all that the market will be a greater success than the existing one in Farringdon Street. The question will presently be asked, what is to be done with old Farringdon Market? and we may point out that its disuse will give the Corporation of London an opportunity of fulfilling a moral, if not a legal obligation. We believe that when the Holborn Valley Improvement Act was passed, it was at least understood that the Corporation were to do something towards providing dwellings for the large number of poor who were dislodged by the improvements. Nothing, however, has yet been done. The present Farringdon Market, however, can be easily transformed into blocks of lodging-houses like Peabody Square, in the Blackfriars Road. There would be a large square, with an excellent playground for children. It might be necessary, to obtain light and air,

to bring the eastern block forward to Farringdon Street, necessitating the removal of a few houses in that street; but this, we imagine, would not cost much. Model lodging-houses pay, which is more than can be said for most of the Corporation markets, and on this account we commend our idea to the attention of the Common Council. There is another consideration, and it is that whatever the Corporation of London does is well done, and we should expect to see grow up the most perfect specimens of buildings of the kind that have yet been erected.

Another Cholera Conference is now sitting—this time at Vienna. The disease is endemic in certain parts of India, and usually travels thence to Europe through Russia. The question discussed is, how is it to be prevented from spreading in Europe? Until the means by which it is transmitted are better understood, we cannot expect much good to result from these conferences. The telegraphic accounts received of the discussions are perfectly unintelligible, and we must be content to wait for the conclusions arrived at.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

XX.

Fire-Clay and Retorts.

Before commencing the description of the structures and apparatus employed when coal is distilled for illuminating gas, which will form the next division of our work, we may give a brief account of the materials used in the constructions. Of these, the clay of which fire-bricks and retorts are made, is the only one that calls for particular notice. The essential character of a fire-clay, and therefore of the articles made from it, are infusibility, and unalterability when exposed to a high temperature. As a rule, all bodies expand when exposed to heat. Clay forms an exception. When alumina predominates in its composition, a clay will shrink when heated. When oxide of iron, lime, or alkalies are present in more than a very small proportion, a clay will run or fuse when exposed to a violent heat. But happily there is found closely associated with coal, and often in the same mine, the very material wanted for the utilization of the coal in gas making—viz., an infusible clay adapted for the production of fire-bricks and retorts. The chemical composition of this clay may be illustrated by the following analyses of clays found in coal mines in the neighbourhood of Newcastle-on-Tyne, and used by Messrs. Cowen and Co. in the manufacture of their justly-celebrated bricks and retorts:—

Newcastle Fire-Clays.

—	1.	2.	3.	4.	5.	6.	7.
Silica. . .	51·10	47·55	48·55	51·11	71·28	83·29	69·25
Alumina. .	31·35	29·50	30·25	30·40	17·75	8·10	17·90
Oxide of iron	4·63	9·13	4·06	4·91	} 2·43	1·88	2·97
Lime. . .	1·46	1·34	1·66	1·76			
Magnesia .	1·54	0·71	1·91	Trace.	2·30	2·99	1·30
Water and organic matter	} 10·47	12·01	10·67	12·29	6·94	3·64	7·50

It may be said broadly that a clay containing less than 60 per cent. of silica or more than 6 per cent. of oxide of iron is not fitted for the manufacture of either fire-bricks or retorts. In actual practice, therefore, the clays having the above composition are mixed in definite proportions, according to the purpose to which the compound is to be applied. Before use, however, the clays are left exposed to the weather for one or several years, and are carefully picked over, to remove pyrites and other objectionable materials naturally associated with clay. When intended for retorts, the clay is mixed with a quantity of sawdust, which gives lightness, and, when burned, a more open structure to the mass, which diminishes the liability to cracking on sudden variation of temperature.

Clay suitable for retorts, as well as bricks, is also found at Kilmarnock, in Ayrshire, while fire-bricks are made from clay found in many localities. We append analyses of some of these, calling attention to the fact that they are made of the dry material, and that moisture is not returned, as with the Newcastle clays above.

—	Silica.	Alumina.	Peroxide of Iron.	Lime.	Magnesia.	Potassa.	Soda.	Titanic Acid.	Total.
Stourbridge . . .	65·37	26·48	5·68	·28	·33	1·26	·30	·30	100·00
Plympton, Devonshire	74·02	21·37	1·94	·40	·36	·82	·09	—	100·00
Burton-on-Trent . .	58·08	36·89	2·26	·55	·14	·20	1·88	—	100·00
Wortley, near Leeds .	65·25	29·71	3·07	·40	·61	·43	·12	·41	100·00
Poole, Dorsetshire .	59·35	34·32	2·35	·43	·22	3·33	—	—	100·00
Hedgerley, Bucks. .	84·65	8·85	4·25	1·90	·35	—	—	—	100·00
Kilmarnock, Ayrshire	58·92	35·65	2·49	·39	·35	1·14	1·06	—	100·00
Dinas, Glamorganshire	97·62	1·40	·49	·29	—	·10	·10	—	100·00

The last on the list, it will be seen, is not a true clay. It is really a siliceous rock of a very infusible character, and the bricks made of it are specially adapted for the arches of furnaces, while the more aluminous may form the sides.

It may be well for a gas manager to know how, independent of an analysis, to test the quality of a fire-brick offered for his use. The simplest and perhaps the best method is to place a row of them on the bridge of a furnace, and expose them to a hard firing for a week or more. If at the end of this time any alteration of shape or trace of fusion should be observed, the bricks should be rejected. A more stringent test of the value of a fire-clay has been proposed by Dr. Percy, who recommends that the clay should be formed into sharp-edged prisms, which are to be enclosed in a covered crucible, and exposed to the intense heat of an air or blast furnace. If the edges remain sharp, it shows that the clay is of excellent quality; if, on the contrary, the edges become rounded and smooth, it is a sign that some fusion has taken place, and that the quality of the clay is inferior.

Communicated Article.

THE PRINCIPLE OF THE VALUATION OF GAS COAL.

By D. A. Graham, Stalybridge.

(*Continued from p. 763, vol. xxiii.*)

We have just shown that a candle produced from this coal, producing 10·665 cubic feet of 14·3-candle gas, was worth 0·74d., when this coal was selling at 20s. delivered; and that a candle produced from this cannel, producing 10·875 cubic feet of 24·25-candle gas, was worth 0·84d., when this cannel was selling at 30s. delivered; and we further showed that when the difference of the differences of the values of this coal and cannel were estimated, the candle would be worth 0·98d., and that the winter's value of this difference, when this cannel was selling at 35s. delivered, would be equal to 1·51d., or 1½d. fully

$$\frac{5s. + 9s.\ 1d.}{111{\cdot}31} = 1{\cdot}51d.$$

Before applying these values of a candle to the valuation of other coals or cannel, we shall endeavour to examine into the principle of this method of determining the foregoing values of a candle from the difference of the differences of the products of the illuminating into the productive power—as this value can be ascertained from using mixtures of any particular coals or cannels. But previous to again applying this method to the coal and cannel under consideration, and which were selected as fitting standards of comparison—we shall for the present substitute others, which, having the advantage of not possessing fractional numbers and quantities to express qualities, may for this reason be more conveniently employed to illustrate the principles involved in the application of this system of valuation.

Geometrical methods of computation have recently been extensively employed—frequently to the exclusion of formulætic systems of accomplishing the same object.

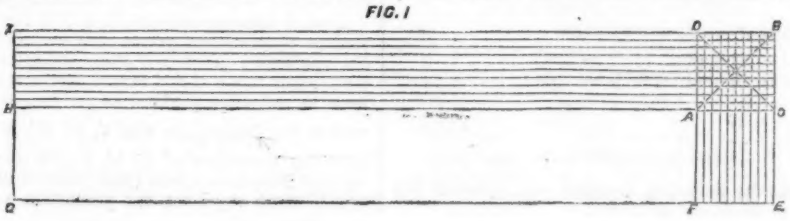
The French, especially, have successfully adopted this system for the calculation of strains for girders, roofs, bridges, and similar structures; and Newton extensively employed constructive methods of demonstration to illustrate the principles of natural laws when treating of them in his *Principia*; and one great advantage of this system over formulætic methods is, that, if the principles be correctly understood and applied, there is very much less chance of committing errors in the calculations, which are but too apt to make their appearance in the use of formulætic methods.

Indeed, the one system is admirably adapted to be used as a corrective against the other, for, while it may not always be possible to ascertain the exact value of a quantity from constructive methods, they nevertheless check results obtained from calculation, and show when these latter coincide with the diagram, fixing the accurate limit of value.

A line may, therefore, be made of such a length as shall express the quantity of gas made from a ton of a particular coal or cannel, and another line may be made to represent the illuminating power of that coal or cannel, and the rectangle of these two lines may therefore be made to represent the cubic feet multiplied by the number of candles which represent the value of the illuminating power; and another coal or cannel producing other quantities or qualities may, therefore, be conveniently compared with this rectangle by placing the two rectangles together in such manner as shall make the sides of the one coincide with two sides of the other, the space between representing the values of the difference of the differences, from which we computed the values of a candle.

Thus, in this diagram, let the rectangle I B E G represent the number of candles I G (= 22) multiplied by the production per ton this cannel produces = G E = 10,000 cubic feet—and let the rectangle G H A F represent the illuminating power multiplied by the production of a coal producing 9000 cubic feet (= G F:) of 12-candle gas = H G. Then the difference of the areas of these two

FIG. 1



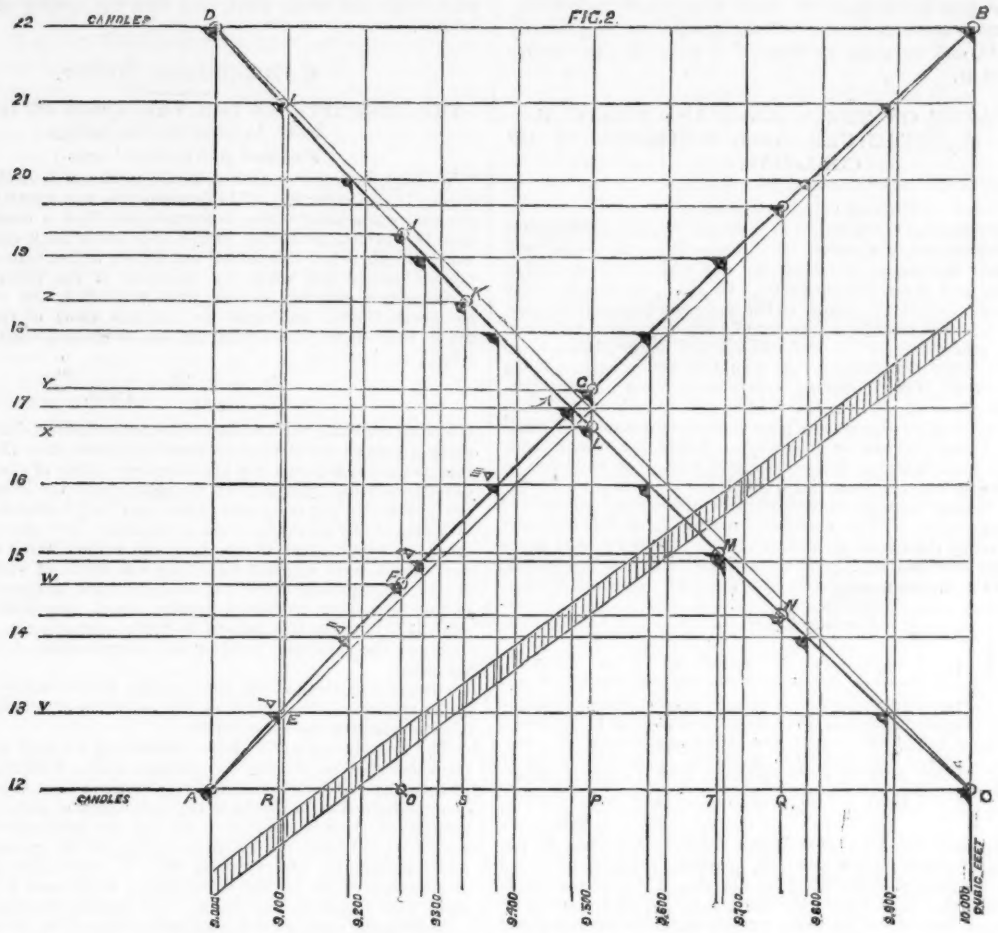
rectangles, = the rectangle I B C H + A C E F, would represent the amount of this difference of the differences of the two values from which the value 0·96d. and 1·51d. was obtained.

In using mixtures of coals and cannels, we have heard some eminent authorities affirm, that the production per ton a mixture of coal and cannel will yield, is increased beyond the proportion of the production of the per centages of each material used; so that, for a coal producing 9000 cubic feet and a cannel producing 10,000 cubic feet, when each were wrought separately—a mixture of half and half of each would produce more than 9500 cubic feet, which number would correspond to the proportional production of the mixture viewed apart from this consideration.

This statement may be correct; but, whether it be so or not, we cannot see how such a consideration can affect the value of the coal, for it could only do so on the supposition that particular per centages were to be used to obtain this value, which would be absurd: while, therefore, the chemical combinations which produced such results would be advantageous to gas companies, they could not be applied to the valuation of a coal or cannel; for, if the whole of the production were produced from either, the production would be proportionally less than when the mixture was used, so that the values could not fairly be estimated at more than what they could produce when distilled by themselves.

Assuming, therefore, that the production per ton was proportional to the mixtures used, which—putting chemical reasons aside—seems to be the most reasonable assumption, and is, at least, the one most in accordance with the principles of valuation, we shall proceed to show a diagrametic method of obtaining either the value of a candle per 1000, or the per centages of coal and cannel required to be used to obtain any particular result with any arbitrary mixtures of them.

FIG. 2.



In this diagram, let the figure A D B C represent the figure A D B C in the diagram already referred to, and divide it horizontally into such equal parts as shall represent the equal divisions of the candles 12, 13, 14, 15, &c., &c., and let the line A C = 1000, the difference between 9000 and 10,000 cubic feet.

The cannel is one which produces 10,000 cubic feet of 22-candle gas, and the coal produces 9000 cubic feet of 12-candle gas.

Three-fourths cannel and one-fourth coal will, therefore, produce:

$$1 \times 9 = 9, \text{ and } 9 \times 12 = 108$$
$$3 \times 10 = 30, \text{ and } 30 \times 22 = 660$$

4)39 768(19·69

9·750 feet of 19·69-candle gas.

Half cannel and half coal will produce:

$$9 \times 12 = 108$$
$$10 \times 22 = 220$$

2)19 328

9·500 feet of 17·26-candle gas.

And three of coal to one of cannel will produce:

$$3 \times 9 = 27, \text{ and } 27 \times 12 = 324$$
$$1 \times 10 = 10, \text{ and } 10 \times 22 = 220$$

4)37 544

9·250 feet of 14·7-candle gas.

From this we find that the following numbers will represent the productions per ton of these several mixtures:—

Cannel.		Coal.				
100	per cent.	0	per cent.	= 10,000	cubic feet of	22 candle gas.
75	,,	25	,,	= 9,750	,,	19·69 ,,
50	,,	50	,,	= 9,500	,,	17·26 ,,
25	,,	75	,,	= 9,250	,,	14·70 ,,
0	,,	100	,,	= 9,000	,,	12·00 ,,

Lay off co-ordinate lines, which shall represent these results—that is, let B represent the *locus* or position of the point which shall represent 10,000 cubic feet of 22-candle gas; H, 9750 cubic feet of 19·69-candle gas; G, 9500 cubic feet of 17·26-candle gas; F, 9250 cubic feet of 14·70-candle gas; and A, 9000 cubic feet of 12-candle gas. Draw the straight line A B, and it will be found that it does not pass through these points; but the curved line which will pass through them will be the line A F G H B. It will be seen that 22 − 12 = 10 will be the sum of the series of candles here represented, and that 10,000 − 9000 = 1000 will be the sum of the differences of the productions = A C. The intermediate values could be ascertained from this and other data, and the nature of this curve and series could be ascertained, which, formulated, would give expression to the ratios of each difference of a candle shown on this curve—but at present we shall confine ourselves to the demonstration of certain other peculiarities of this curve, leaving this matter to be treated of on some future occasion.

Now, if these several points, A F G H B, represent a curve which shall at these several points represent the illuminating power and the production per ton of these several mixtures from various per centages of this coal and cannel, this curve must also determine the *locus* for all other productions per ton, and all illuminating powers within the limits $\frac{A}{B}$, so that Δ', Δ'', Δ''', Δ'''' and K will respectively represent the values of 13, 14, 15, 16, and 17-candle gas; and the vertical lines drawn from these points will limit the length of lines which shall represent the production per ton the mixtures pro-

ducing those several qualities of gas will produce, and the proportions or per centages of these mixtures can be determined in a very simple manner. For it will be observed that 9500 is an arithmetical mean between 10,000 and 9000, and that

$$\frac{(9 \times 3) + 10}{4} = 9250, \text{ and } \frac{(10 \times 3) + 9}{4} = 9750;$$

and that these are three such numbers as divide the line $10{,}000 - 9000 = 1000$ into four equal quantities or parts. Vertical lines drawn from these four equal divisions will, of course, divide the diagonal or straight line drawn from any scale of equal parts into four equal divisions, and as this line is divided into 100 equal parts, it follows that each of these divisions will divide it into four equal parts containing 25 divisions each; so that for division O, if the proportion be taken *inversely*, 75 per cent. of this cannel, mixed with 25 per cent. of this coal, will produce 9·250 cubic feet of 14·7 candle gas. But what is true of these four divisions will also be true of all others; therefore, vertical lines drawn from any candle line which intersects the curve will enclose a rectangle, whose length will express the amount of the make, and whose breadth shall represent the illuminating power the mixture will produce, and the per centage of coal and cannel required to manufacture this quality can be read off at the point where the vertical line intersects the scale.

Thus, for 13-candle gas: the production per ton can be measured from the vertical line passing through 9·1 in the scale, which distance can either be measured with a diagonal scale or from the line of lines on the limbs of a sector, or, in the case assumed, from the diagonal scale drawn.

Consequently, 9·1 per cent. of cannel producing 10,000 cubic feet of 22-candle gas + 90·9 per cent. of coal producing 9000 cubic feet of 12-candle gas will together produce 9091 cubic feet of 13-candle gas.

For $9{\cdot}1 \times 10 = 910$, which multiplied by $22 = 20{,}020$
And $90{\cdot}9 \times 9 = 8181$, " " $12 = 98{,}172$

9091 118,192

And 9091) 118192 (13
9091

27282
27273

Now, the difference between all the values of the various products produced from 9·1 per cent. of this cannel, and 90·9 per cent. of this coal, the mixture producing 9091 cubic feet of 13-candle gas, and the various costs involved in manufacturing from this mixture, compared with the same charges for the coal producing 9000 cubic feet of 12-candle gas, would form a basis from which the value of a candle could be accurately ascertained, which method we shall endeavour to apply to the coal and cannel already selected as the standard of comparison.

Before passing on, however, it may be well to observe the nature of another curve obtained in a similar manner to that just enunciated.

Thus, let the productions per ton be the converse of those used for the last demonstration—namely, cannel producing 9000 cubic feet of 22-candle gas, and the coal producing 10,000 cubic feet of 12-candle gas. In this case, the nature of the curve has been ascertained for seven points.

Cannel . .	0	25	33	50	66	75	100
Coal . . .	100	75	66	50	33	25	0

These per centages would be represented by the line—

δ, T, J, K, L, M, N, C,

this curve being concave, while the other was convex; and it will be observed that they intersect at the point π, which is a point so situated that on the two opposite suppositions — either that coal produces 9000 cubic feet of 12-candle gas, and cannel 10,000 cubic feet of 22-candle gas, or that coal produces 10,000 cubic feet of 12-candle gas, and the cannel produces 9000 cubic feet of 22-candle gas—would represent the position of a point, where 9475 cubic feet of 17-candle gas could be manufactured from 47·5 per cent. of the cannel, producing 10,000 cubic feet of 22-candle gas, *plus* 52·5 per cent. of a coal producing 9000 cubic feet of 12-candle gas; or this same quality and quantity—17-candle gas and 9475 cubic feet per ton—could also be produced from 52·6 per cent. of a cannel producing 9000 cubic feet of 22-candle gas, and 47·4 per cent. of coal producing 10,000 cubic feet of 12-candle gas—results which have been obtained from using the diagonal scale, but which will be found to nearly correspond to those which might have been obtained by calculation.

Thus:

$10 \times 22 = 220$, and $220 \times 47{\cdot}4 = 104{,}280$
$9 \times 12 = 108$, and $108 \times 52{\cdot}6 = 56{,}808$

161,088

$$\text{And } \frac{161{,}088}{17 \text{ candles}} = 9475 \text{ cubic feet.}$$

And:

$9 \times 22 = 198$, and $198 \times 52{\cdot}6 = 10{,}414{\cdot}8$
$10 \times 12 = 120$, and $120 \times 47{\cdot}4 = 5{,}688\ 0$

16,102·8

$$\text{And } \frac{161{,}028}{17} = 9472 \text{ cubic feet.}$$

(To be continued.)

Correspondence.

GAS PURIFICATION.

SIR,—The weary distance that separates us from England, out in this far country, prevents our being cognizant of what is taking place at home until several weeks have elapsed. This will account for the lateness of my reply to the letter of Mr. R. H. Patterson, that appeared in the JOURNAL of the 28th of April on the above subject, the writing of which was occasioned by a paragraph in the new edition of the "Gas Manager's Handbook."

In the work referred to, I have endeavoured to give a succinct statement of the best known methods that are employed, or that have been suggested, for the purification of coal gas, not only from sulphuretted hydrogen, but from the other sulphur compounds existing therein.

After paying my humble tribute to the late referees, for their able and valuable researches in this direction, and for the practical suggestions they made in their several reports on this and other subjects, I take occasion, in speaking of the purification of coal gas, to remark that the property of absorbing or arresting bisulphide or disulphide of carbon, possessed by the sulphide of calcium, was known by some of our ablest chemists and most observant managers of gas-works, for a period considerably anterior to the date of the publication of either the able report of the referees, or the valuable lecture of Dr. Odling,* and the principle of purification therein recommended acted on in a greater or less degree; and, in support of this assertion, I gave an extract from a paper communicated by Dr. Letheby to the British Association of Gas Managers, in June, 1870, and printed in the minutes of proceedings (page 89) for that year.

Exception is taken by Mr. Patterson to this statement of mine, and he asserts in his letter of the 28th of April that "Dr. Letheby's words not merely do not support the author's remark, but directly contradict it;" and to show that such is the case, he quotes a portion of Dr. Letheby's communication above referred to. Now, as that which Mr. Patterson quotes is not as ample as the extract given in the "Handbook" (p. 55), and as the subject is one of so much importance, I will, without apology, reproduce the latter here.

Dr. Letheby, speaking of the mode of purification pursued at the Great Central works, and after referring to the scrubbers, goes on to say:

> The gas is then passed through a series of dry lime purifiers, which present a very large surface for absorption; and the lime is purposely left in the purifiers after it has become foul, and until a good deal of the sulphuretted hydrogen first absorbed is displaced by carbonic acid. In this manner the natural affinity of sulphide of calcium for bisulphide of carbon is permitted to act, and much sulphur, in this objectionable form, is retained. Leaving the lime purifiers, the gas, which is still charged with more or less of sulphuretted hydrogen, is passed through oxide of iron. . . . The chemical effect of these operations is very intelligible, for sulphide of ammonium (in the scrubbers, &c.) and sulphide of calcium are both endowed with the power of combining with bisulphide of carbon, and therefore of absorbing and fixing this objectionable impurity. It is manifestly, then, of the greatest importance that coal gas should be kept in contact with these substances as long as possible during the process of purification. . . . In the case of sulphide of calcium, it should be permitted to act for some time after the lime has become foul, for it is in this condition that it is most effective, and a lime purifier should not be changed until the sulphuretted hydrogen of the foul lime is largely displaced by the carbonic acid of the raw gas. If it be necessary to use oxide of iron, it should be used after the lime.

Now, I put it to any unprejudiced reader to say in what respect the words of Dr. Letheby, as given above, can be said to contradict what I have affirmed—viz., that the principle of purification recommended by the referees was known and acted on, in a greater or less degree, prior to the publication of their report.

After quoting a portion of the above extract, Mr. Patterson goes on to say:

> It is needless to observe that there is here no process for producing sulphide of calcium as I have given, nor for decarbonating the gas before it enters the sulphide of calcium.

Who said there was? Not the present writer, certainly. But, further, Mr. Patterson proceeds—and it occasions me no ordinary surprise that such a misapprehension of plain words is possible—

> Even the *principle* of the foregoing quotation—which is, that lime in purifiers acts most efficiently upon the bisulphide of carbon after it is being carbonated and desulphuretted—is entirely wrong.

I dispute, most emphatically, that such is the principle enunciated in the quotation. It is, in truth, the direct opposite of this. The gist of the whole is simply, that *sulphide of calcium is endowed with the power of combining with bisulphide of carbon, and therefore of absorbing and fixing this objectionable impurity, and that it is of the greatest importance that coal gas should be kept in contact with that substance as long as possible during the process of purification; that in order to bring about this contact the lime is purposely left in the purifier after it has become foul (that is, after a large proportion of it has become converted into sulphide of calcium), and that the time for changing the purifier is when the sulphuretted hydrogen first absorbed is being largely displaced by carbonic acid.* Such is the true spirit of the words, and in this sense I understood them at the time of their appearance in 1870. Indeed, the principle is so clearly expressed, that I can only wonder there should be the slightest misapprehension on the part of even the most superficial reader.

It should be observed that I do not say that the plan above recommended, for effecting the elimination of the sulphur compounds, is the best that can be adopted, or that it will enable us to extract the whole of these impurities. I am persuaded that, to reap the full benefit of the sulphide of calcium formed in the purifiers, and to accomplish the perfect purification of coal gas from the sulphur compounds, we must either employ three sets of purifiers, through which the gas must pass in consecutive order, as suggested by Dr. Odling, or we must adopt Mr. Patterson's method of decarbonating the gas before it comes in contact with the sulphide of calcium.

It is quite competent for Mr. Patterson to say, as he has repeatedly said, that the excessive quantity of sulphur present in the Beckton gas, in March, 1872, is proof in itself of the insufficiency of the plan pursued. No doubt that is so; but the question comes, "Was the plan there adopted in reality that which is recommended by Dr. Letheby in the

* Lecture on "Sulphide of Carbon," delivered by Dr. Odling, F.R.S., at the annual meeting of the British Association of Gas Managers, held in London, in June, 1872.

words above given?" I am certain it was not; and the departure from good advice, both in this instance and in many others, arose either from a want of due appreciation of the value of the sulphide of calcium as a purifying agent, or the inability of those in charge to act upon it, for lack of that ample purifying area which is so essential to the carrying of it into practice.

I for one decline to accept (as Mr. Patterson suggests) the practice at the Beckton works, above all others, as showing the best method then (1872) known of sulphur purification. The best method was that of those managers who pursued the practice as indicated in the above quotation from the communication of Dr. Letheby, and who were able to produce gas from exactly similar materials, as were employed at Beckton, with a maximum of 10 to 14 grains of sulphur per 100 cubic feet.

It is true, moreover, that at that time gas managers were peering into the clouds for a remedy for the sulphur compounds, not fully (though in part) appreciating the simple and efficient agent ready to their hands. Even to the extent that it was understood and employed, it was viewed as a make-shift—a mere ameliorating agent—until something better could be discovered.

In conclusion, I hope that Mr. Patterson (of whose abilities I entertain a very high opinion) will excuse me for saying that he makes a mistake when he insists on being recognized as the first discoverer of the process for removing the sulphur compounds. He may have been a discoverer for aught I know, though in this instance he was not the first in the field. He was, however, something as good, if not better—he was the first to recognize the full value of the process, and the paramount necessity, if he would eliminate the whole of the sulphur impurities, of decarbonating the gas by a previous operation, and this in itself confers a distinction that most of us might envy.

Gas-Works, Pernambuco, May 30, 1874. THOS. NEWBIGGING.

SIR,—As no one questioned the chemistry of the mode of purifying gas by lime, which I described in my paper read at the last meeting of the Gas Managers Association, I withheld some chemical analysis I had with me of the constituents of foul lime from the Dover and from the Cork Gas-Works.

As the lime from the purifiers on those works, when taken from the purifiers, is as near as possible without smell, chemists have thought that the sulphur must be driven out of it; and, consequently, the time would come when the whole range of purifiers would get so charged with sulphur that it would be impossible to make clean gas.

At the Dover works the gas has been so purified for the last 10 years, and this anticipated result has not arrived yet. Indeed, we are now purifying the gas of over 70 tons of Newcastle coal for every ton of chalk lime employed.

As the discussion did not draw out the analysis I had in my pocket, it has occurred to me that its publication in that number of your JOURNAL that contains your print of the paper might be useful to many chemical friends whose minds are now engaged on that subject.

Northumberland Street, July 3, 1874. GEORGE ANDERSON.

ANALYSIS OF FOUL LIME.

Dover Gas-Works—Chalk Lime.

Moisture expelled at 230°	13·73
Carbonate of lime	79·88
Sulphide of calcium	1·44
Sulphate of lime	1·85
Siliceous matter	3·10
	100·00

Cork Gas-Works—Blue Limestone Lime.

Carbonate of lime	64·40
Sulphite of lime and a trace of sulphide of calcium	11·84
Sulphate of lime	1·41
Oxide of iron	0·30
Organic matter	4·69
Siliceous matter	2·76
Moisture	14·60
	100·00

OBLIGATIONS OF GAS COMPANIES.

SIR,—A "Country Manager" asks if a gas company can refuse to supply gas to a house when they consider the interior pipes too small for the number of lights required, and, if so, under what Act.

Companies under the Gas-Works Clauses Act, 1871—*i.e.*, all gas companies incorporated, or obtaining amendment Acts, since July, 1871—are bound to supply gas under certain conditions, but no exemption is made for bad fittings. If the company in question is not under that Act they *may* refuse, the only remedy the consumer would have against them being a civil action for damages. But why should the "Country Manager" refuse? If it were my case, I should lay on a service and fix a meter of the required size, giving a written notice to the consumer that his fittings were too small, and that a bad light would be the result. I should let him burn all the gas he could get through his fittings; it would all bring "grist to my mill," and I should recommend a "Country manager" to connect the pipes, and let the consumer burn *all he can*.

Lower Sydenham, S.E. MAGNUS OHREN.

SIR,—In reply to your correspondent, "A Country Manager," I believe I am correct in stating that no company in the metropolis could refuse to supply a consumer for the fault of "small fittings." Some small country companies may do so under any circumstances, therefore would include the above; but the question is, Is it wise to do so? To interfere in any way with inside work would be to take an amount of responsibility which would be best left alone. The district I am engaged in is a large one, and the complaints arising from smallness of fittings very numerous, but I find the pocket pressure-gauge a beautiful convincer of the most stubborn as to where lies the fault of "bad light."

London, July 4. INSPECTOR.

THE AUTOMATIC SEWAGE-METER.

SIR,—In your JOURNAL of the 23rd ult. we noticed a letter, signed "T. Mellard Reade, Civil Engineer," stating that our self-acting sewage regulator embodies a principle that he invented and patented, in conjunction with Mr. Josh. Hewitt, for the regulation of the supply of water to water-closets, and other purposes; and that it was long his "intention to adopt the principle for an automatic flushing-chamber, which would receive water or sewage in a small stream, and discharge it periodically with a flush; but this intention, from various causes, was never actually carried into execution."

As to what Mr. Reade's intention was, we, of course, know nothing. All we can say is that the action of his apparatus, so far as it is described in his specification, is not automatic.

With regard to the difficulties which Mr. Reade goes on to state he thinks we shall discover on practical application, we have the satisfaction to state that the regulator has now been in use for two years at Eastwick, near Leatherhead, in Surrey, for the disposal of the sewage of the residence of the late Mr. Hedworth Barclay, the village of Eastwick, and the Home Farm; and no difficulty whatever has been experienced in its use. The sewage is there applied intermittently to about three-quarters of an acre of land with considerable profit, and Mr. Andrew Hutchinson, who has the management of the Eastwick Estate, will gladly show the regulator and the sewaged land to any one interested.

BAILEY DENTON AND ROGERS FIELD.

22, *Whitehall Place, London, S.W., July* 2, 1874.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 29, 1874.

The Commons amendments to the Middlesborough Extension and Improvement Bill were considered; some of the amendments were agreed to; one was disagreed to, and a committee was appointed to prepare a reason to be offered to the Commons for the Lords disagreeing with one of their amendments to the Bill. This was read and agreed to, and a message was sent to the Commons to return the Bill, with the reason.

The Wigan Improvement, and Belfast Water Bills were reported, with amendments.

The Padiham Water Bill was read the third time, and passed.

The Dublin Corporation Water, and Dundee Water Bills were referred to a Select Committee, consisting of the Earl of Devon (chairman), the Marquis of Hertford, Viscount Hardinge, Lord Penrhyn, and Lord Wolverton; to meet on Friday, July 3.

TUESDAY, JUNE 30.

The following Bills received the Royal Assent:—Gas Orders Confirmation, Grantham Gas, Lymm Water, Hartlepool Gas and Water, Leeds Corporation Water, &c., Peterborough Gas, Enniskillen Gas, Fylde Water, Fairfield Local Board, Wrexham Water, Llanelly Gas, Aberdare and Aberaman Gas, Chester Water, Hythe Improvement and Water, Westleigh, Pennington, and Bedford Local Boards, and Padiham Water Bills.

The Skipton Local Board of Health Bill was reported, with amendments.

THURSDAY, JULY 2.

The Belfast Corporation Gas Bill was reported, with amendments.

FRIDAY, JULY 3.

The Ulverston Local Board Bill was reported, with an amendment.

The Wigan Improvement, Belfast Water, and Skipton Local Board of Health Bills were read the third time, with the amendments, passed, and sent to the Commons.

The Dublin Corporation Water Bill was reported from the Select Committee, with amendments.

A report was read from the Select Committee on the Dundee Water Bill, "That the committee had not proceeded with the consideration of the bill, the opposition thereto having been withdrawn." The orders made on the 18th and 29th of June were discharged, and the bill committed for Tuesday, July 7.

The Neath Corporation Bill was returned from the Commons agreed to, with amendments, which were considered and agreed to.

The Gas and Water Orders Confirmation Bill was returned from the Commons agreed to.

The Horbury Local Board Bill was returned from the Commons with the amendments agreed to.

The committee on the Edinburgh and District Water Bill, appointed on the 19th of June, were discharged, and the Bill committed to a Select Committee, consisting of the Duke of Somerset (chairman), Earl Bandon, Viscount Hereford, Lord Foxford, and Lord Emly, to meet on Tuesday, July 7.

HOUSE OF COMMONS.

MONDAY, JUNE 29, 1874.

The Neath Corporation Bill (Lords), as amended, was considered; to be read the third time.

The committee on the Sanitary Laws Amendment Bill was deferred till Thursday, July 2.

TUESDAY, JUNE 30.

The Shipley Local Board of Health Bill, as amended, was considered; to be read the third time.

The Nottingham Water, and Ystrad Gas and Water Bills (Lords) were referred to a Select Committee, consisting of Mr. Richard Bright (chairman), Sir R. B. Harvey, Mr. Price, Captain Nolan, and Sir J. Duckworth (referee); to meet on Tuesday, July 7.

WEDNESDAY, JULY 1.

The Gas and Water Orders Confirmation Bill (Lords) was considered in committee and reported without amendment.

A requisition was lodged by James Harvey Insole to withdraw his petition against the Ystrad Gas and Water Bill (Lords).

THURSDAY, JULY 2.

The Lords amendments to the Horbury Local Board Bill were agreed to.

The Neath Corporation Bill (Lords) was read the third time, and passed, with amendments.

The Alliance and Dublin Consumers Gas Bill (Lords) was reported, with amendments.

The Nottingham Corporation Gas Bill (Lords) was reported, with an amendment.

The committee on the Sanitary Laws Amendment Bill was deferred till Friday, July 3.

The Gas and Water Orders Confirmation Bill (Lords) was read the third time, and passed.

FRIDAY, JULY 3.

The Lords reason for disagreeing to one of the Commons amendments to the Middlesborough Extension and Improvement Bill (Lords) was considered, and, on the motion of Sir Charles Forster, it was resolved—"That this House doth not insist upon the amendment to which the Lords have disagreed."

The Shipley Local Board of Health Bill (Lords) was read the third time, and passed, with amendments.

The committee on the Sanitary Laws Amendment Bill was again deferred till Monday, July 6.

Legal Intelligence.

COURT OF CHANCERY—Thursday, July 2.

(*Before the* Lords Justices of Appeal.)

CORPORATION OF HALIFAX *v.* SOOTHILL UPPER LOCAL BOARD.

This was an appeal by the plaintiffs from a decision of Vice-Chancellor Bacon. Mr. Kay, Q.C., and Mr. W. Barber appeared for the appellants; Mr. Jackson, Q.C., and Mr. Ince for the defendants.

This suit was instituted to restrain the defendants from requiring the corporation to supply them with, and from taking from the corporation any water except such as, being within the minimum and maximum limits defined by the Act of 1870, should be required for consumption within the township of Soothill Upper by the owners and occupiers of property within the township. It appears that by virtue of certain Acts of Parliament passed in the years 1868 and 1870, the Corporation of Halifax were enabled to construct reservoirs on, and procure water from, a tract of moorland on the Saville estate. Provisions were inserted in these Acts to carry out an agreement made with Mr. Henry Saville, the tenant for life of that estate, under which he withdrew parliamentary opposition in consideration of those provisions being inserted to protect the water supply of the Saville property. The effect of these provisions was that the three townships of Soothill Upper, Thornhill, and Mirfield, which were to a great extent situated within the Saville estate, should be entitled, on giving notice, to receive a water supply from the Halifax Corporation. A local board was formed for the township of Soothill Upper, and notice was given to the Halifax Corporation to supply them with water, and Soothill Upper is now receiving water from Halifax. Under existing circumstances the corporation are bound to supply the local board with a maximum of 45,000 gallons a day, at the rate of 6d. per 1000 gallons, and the Soothill Upper Board are bound to pay for a minimum of 25,000 gallons a day. They have contracted to resell some of the water thus supplied to them to the Horbury Local Board at the rate of 11d. per 1000 gallons. Soothill Upper is 11 miles, and Horbury is 15 miles from Halifax. When the corporation have constructed additional reservoirs, the maximum and minimum quantities of water which they will have to supply to the three townships, and be entitled to be paid for, will be considerably increased, amounting ultimately to 1 million and 300,000 gallons a day respectively. The case came before Vice-Chancellor Bacon on a demurrer to the bill, and a report of the proceedings appeared in the Journal, vol. xxiii., p. 810. The Vice-Chancellor allowed the demurrer, and the plaintiffs now appealed.

The court gave judgment without calling upon the defendants counsel.

Lord Justice James said this was as plain a case as ever came into court. He entirely agreed with every word of the Vice-Chancellor's judgment. The plaintiff's case was as idle in point of law as it was dishonest in point of fact.

Lord Justice Mellish was of the same opinion. Mr. Saville had a large estate, upon which, from its situation near Halifax, there was likely to be a great deal of building. It appeared also to be suitable for the collection of water. He might have made reservoirs himself, and sold the water. The Corporation of Halifax applied for parliamentary powers to take his water. If no agreement had been come to, they would have had to make him compensation for depriving him of the power of collecting water on his moors and selling it. Then an agreement was entered into for compensating him by means of a supply of water. The question was, what was the construction of the provisions of the Act relating to that? Those provisions must be construed as if they were an agreement by him to sell the water coming from his estate. There was nothing to show that the water which he was to have was to be used strictly to supply the townships on his estate. The provisions for the future increase of the minimum supply were wholly irrespective of the needs of the township on the estate. The whole scheme of the Act was to give Mr. Saville a compensation in water for the use by the corporation of his moors to collect water for their purposes. There was no restriction in the Act, and it would be very wrong to import any. The appeal must be dismissed with costs.

VICE-CHANCELLOR'S COURT.—Thursday, July 2.

(*Before Vice-Chancellor* Hall.)

In re the air gaslight company.

On this matter being called on, Mr. Greene, Q.C., said he had not yet been instructed as to whether a meeting had been held, and asked that it might be in the paper on the following day.

The Vice-Chancellor acceded to the application.

Friday, July 3.

This case was again mentioned at the sitting of the court to-day, when Mr. Dickinson, Q.C., who appeared for one of the petitioners, said he had only just had an affidavit put into his hands, which he had not had time to read, and must, therefore, ask for it to stand over.

Mr. Greene said he was instructed the meeting was held on Wednesday, when a resolution was passed.

Mr. Dickinson said, whatever had happened, he had only just been furnished with the affidavit, which he simply desired to read. He only wished it to stand over until the next day.

Mr. Greene said he could not object to that.

Saturday, July 4.

The case was before the court again this morning, and after some discussion the petitions were dismissed. We defer our report till next number.

(*Before Vice-Chancellor* Malins.)

In re the petersburg and viborg gas company.

At the sitting of the court, Mr. Brooksbank (with Mr. Glasse, Q.C.) stated that it had been arranged that the petition should stand over till next petition day, Friday, July 10.

Miscellaneous News.

MONTE VIDEO GAS COMPANY, LIMITED.

An Extraordinary General Meeting of the Shareholders of this Company was held at the City Terminus Hotel, Cannon Street, London, on Thursday last—J. Bramley-Moore, Esq., in the chair—for the purpose of authorizing the creation of new capital.

The Secretary (Mr. J. T. Denniston) having read the notice and the minutes of the last meeting, the following report was presented:—

The shareholders are aware, from the communications which have been made to them by the directors at the last general meeting, that some inconvenience is sustained by the company in consequence of the whole of its share capital having been absorbed in the purchase of the concession and gas-works, without leaving sufficient surplus to provide for the gradual extensions of the gas-works, mains, &c., which are always going on, and the provision of stores.

The board have hitherto made temporary arrangements for providing against the deficiency, but they think that the time has now come, when, in accordance with the desire expressed by the shareholders at the last general meeting, more permanent provision should be made for the purposes above stated. All the expenditure made by the company, and for which the additional capital is required, is essentially reproductive, and considerable economy to the shareholders will be produced by providing the capital themselves, instead of leaving it to be provided by advances.

The amount which in the judgment of the board will be ultimately requisite will be £100,000, but it will not be necessary at present to issue more than £50,000. This will enable them to pay off all the advances they have obtained, and will leave a sufficient surplus to provide for the necessary stock of materials, &c., and for the extensions of the works, which the increasingly profitable business of the company at present renders necessary. Having regard to the exceedingly favourable position and prospects of the company, the directors think that the additional capital should be raised by an issue of shares, at a premium; which latter they propose to employ in augmenting the insurance and contingency fund of the company. They propose also that a preference should be given to the shareholders in the new issue in proportion to the number of shares held by them.

In order to carry out this plan, it will be necessary to obtain the authority of the shareholders, and in the accompanying notice of the general meeting called for that purpose will be found a statement of the powers for which the directors propose to ask.

The directors are glad to be able to say that, by the last reports from Monte Video, the condition of the company's gas-works and business continues satisfactory.

The consumption of gas continues steadily to increase; the price of coals, as the shareholders know, has fallen considerably; and the board believe there is every prospect of the present prosperity of the company not only being maintained, but increased.

Some of the shareholders having intimated that they believe it would be in accordance with the wishes of the general body of shareholders to make some increase in the remuneration of the directors, taking into consideration the increased amount and the profitable nature of the company's business, the board propose to leave this question to be decided by the general meeting now called.

The Chairman said it would only be necessary to detain the shareholders for a very short time, as they were as well read up in the business of the company as the directors themselves. The report, as they would see, was based entirely upon the opinions expressed by the shareholders at the last meeting. It was perfectly well known that there was a great omission made at the formation of the company in not providing a sufficient working capital. The consequence had been that the directors had been in debt, partly to his Excellency the Baron de Mauà and partly to their bankers. This was a position which the shareholders very properly decided it was not right for the company to remain in, and therefore, at the suggestion of the directors, and by the approval of the shareholders, it was now proposed to increase the share capital. The directors asked for power to raise £100,000—not that they were going to avail themselves of the whole of this, though the sooner it was done the better, because all that was called up beyond £50,000 would be to meet the increased demands upon the company, and therefore productive of revenue hereafter. What the directors contemplated was to issue £50,000 of shares at once, and to exercise the further power now asked for as circumstances required. They were at present under contract for increased plant; they were having a new gasholder erected, and making other arrangements necessitated by the extension of business. It could not but be gratifying to the shareholders to know that these things were required, and that they would add so much to the benefit of the undertaking. The meeting was an extraordinary one, and, strictly speaking, should be confined to the objects mentioned in the notice; but he was not one to draw a hard and fast line, and, therefore, would be happy to give any information that might be required by the shareholders in an unofficial manner. But he could sum up all in a few words, and say the company was going on satisfactorily and prosperously in every possible way. With these remarks, he moved the adoption of the report.

Mr. Youle seconded the motion.

The Secretary, in reply to an inquiry, said the diameter of the new gasholder was 80 feet, and the cost of the iron work, f.o.b., was £4600.

The Chairman said, in addition to the cost of the holder and tank, there was the land upon which it was erecting to be paid for. There were also new mains to be laid. There was £10,000, borrowed of Baron de Mauà, to be repaid, as well as a considerable sum to the bankers. Not one penny of the money would be expended upon the dock.

A Shareholder remarked that in the original prospectus it was stated that the amount paid for the purchase of the undertaking included not only the concession, but the plant, stock, &c., in hand, representing working capital. He could not, therefore, understand the observation made by the chairman that the company never had any working capital. The prospectus also stated that the works were situated in an excellent position on the shore, and were sufficient for the supply of 50 per cent. more gas than was at present consumed. This statement made it difficult to understand the necessity for the extensions mentioned by the directors.

Mr. Mackinnon said, as one of the original engineers of the company, and director-general of public works at Monte Video, he knew every inch of the ground in the locality, and he was aware that the suburbs were extending so rapidly as to render it imperative upon the company to extend their mains, and it was not a question of the laying down of a few miles, but of many miles. He, therefore, considered that it was necessary for the company to have a good margin of surplus capital, so as to meet the enormous increase which was sure to take place in the consumption of gas.

After some further conversation, the motion was put, and carried with four dissentients.

Mr. Clements, the company's solicitor, then read the formal resolutions for, the purpose of authorizing the creation of the new capital. By these resolutions the directors are empowered to increase the capital by a sum of £100,000 in 5000 shares of £20 each, making the total capital £600,000. The shares are to be issued at such a premium and at such times and amounts as the directors think fit. They are to be offered in the first instance to the holders of existing shares *pro ratâ*, and the new shares unaccepted by them are to be allotted and issued by the board to such persons and in such manner, and at such times, prices (not less than the nominal value), and terms as the board shall think fit. The premium on the new shares is to be treated as profit, and carried to the insurance and contingency fund.

The Chairman moved the adoption of the resolutions.

Mr. Youle seconded the motion.

A Shareholder said it had not yet been decided whether the money should be raised by debentures or shares.

The Chairman said the recommendation of the last general meeting was that the directors should take into consideration the best mode of raising the money, and they had decided that it would be better raised by issuing shares.

The motion was put and carried.

Mr. Mackinnon moved a resolution in accordance with the intimation in the last paragraph of the report, increasing the remuneration of the directors from £1000 to £1500 a year, and altering the Articles of Association accordingly.

Mr. Knowles seconded the motion.

The proposition gave rise to considerable discussion, the speakers maintaining that the present was an inopportune time for bringing forward a resolution to increase the expenditure, and that it ought to be deferred until the shareholders received a better dividend.

The Chairman defended the proposition, regretting only that, owing to the constitution of the company, it of necessity originated with the board themselves. The directors had thought it right that on a question of this kind the whole body of shareholders should have the opportunity of expressing an opinion. They had, therefore, sent out proxies, a large number of which had been returned, and two only were adverse. These represented the opinions of one £5 shareholder and one £20 shareholder. If the company were to have the services of efficient directors, they must be prepared to remunerate them properly.

A Shareholder asked what remuneration was fixed by the Articles of Association.

Mr. CLEMENTS said £1000, to be divided among the members as the board from time to time should determine.

Mr. YOULE said two of the present directors would probably be soon retiring, and he did not see how the board could invite efficient men to join them for so small a remuneration.

A SHAREHOLDER suggested that, the question having been brought before the meeting, it should be allowed to stand over for a time.

The CHAIRMAN declined to accept that course, and said the question had been well considered.

The motion was then put, and, on a show of hands, was lost, 6 voting for it, and 11 against.

A poll was demanded by the chairman, the directors, and four of the shareholders who had voted for the proposition.

In answer to an inquiry, the CHAIRMAN said the number of proxies in favour of the motion was 11,463. None of the dissentient shareholders present recorded their votes, and the motion was therefore carried.

This closed the proceedings.

COLCHESTER GAS COMPANY.

The Annual Meeting of this Company was held in the Council Chamber of the Town-Hall, on the 24th ult.—Mr. J. B. HARVEY in the chair.

The report of the directors is as follows:—

Your directors, in submitting their annual statement, regret their inability to report favourably as to the result of the year's working.

The unprecedented price of coal has been the great obstacle to the company's prosperity, and has, throughout the year, occasioned your directors much labour and anxiety.

Last year the expenditure for coal was £5390, being £1321 in excess of the previous year. This year it is £7989, or £2599 in excess of last year, and £3920 over the cost two years ago, when the coal markets were subject to only trifling fluctuations, and when the cost of coal was made the basis, by Parliament, of the statutory maximum of the price of gas.

The progress of the general business of the company has been favourable, and would have been financially successful, but for this unexampled drain upon their resources, which has exhausted nearly the entire profit of the year, and left nothing available for dividend.

Whilst deploring this adverse result, your directors feel it due to themselves to state that the business of the company has been conducted with care and economy. Coal has been bought as cheaply as possible, and the residual products have been sold for the highest prices that could be obtained. Notwithstanding the advance in wages for labour, it will be seen that the sum paid under this head was £63 less than that of last year; whilst for maintenance and repairs the expenditure was £490 less.

The price of coke, which at the beginning of the winter rose considerably, rapidly fell after the lapse of a few weeks, owing to the exceptional mildness of the weather. A larger stock than usual remained on hand at the close of the season, although in this respect, and in the prices at present realized, this company is much better off than many other provincial companies.

Although the price of coal is somewhat reduced, and your directors have recently bought at more favourable quotations, yet there is no prospect that coal will ever recede to the prices of two or three years since. Whilst, therefore, the company will be able to work another year more profitably, the only hope of their being able, in common with numerous other gas companies, permanently to overcome their difficulties, is in legislative relief.

It was for some time confidently expected that the Government would, by some general enactment, relieve the large number of incorporated gas companies, which cannot work at a profit with their present maximum prices, and thus save them from the expense of promoting private bills. There does not, however, at present seem any probability that the Legislature will do anything for the aid of the gas companies generally. Unless, therefore, there should be an immediate and a considerable fall in the price of coal under circumstances which would justify the belief that the reduction is likely to be lasting, the shareholders of this company will, no doubt, feel compelled to apply to Parliament next session for the advance of price.

In the meantime your directors are using every precaution in the purchase of coal; and, as the market appears to have a downward tendency, they have deferred buying their entire stock for the season. Besides anxiously watching the coal market, they are in all respects continuing to practise the utmost economy, consistent with the efficient working of the company.

The CHAIRMAN, in moving the adoption of the report, said one of the great difficulties which had operated against the company in the past year was the price which they had been obliged to pay for coals. The directors hoped, in common with many other companies, that the coke would have produced a much larger return than it had done; but, although before Christmas they were able to obtain a very good price for it, owing to the exceedingly mild weather which followed an immense reduction had taken place in its price. They were not, however, in a worse position than other companies, many having found coke a complete drug on their hands. The existing contract for the ammoniacal liquor expired next Christmas, and they had reason to believe that in the disposal of that article some improvement would be made; but perhaps the most important matter in the report was that part of it which referred to their future. The directors felt that the position of the company pointed to the necessity of obtaining additional powers from Parliament for the purpose of enabling them to increase the price of gas, should that be found necessary. An Act passed in 1873, called the Gas and Water Companies Facilities Amendment Act, enabled companies to apply to the Board of Trade for a Provisional Order to raise the prices of gas or water, that Provisional Order being confirmed by Parliament at its next session. But the unequal and unjust provisions of that Act might be inferred from the fact that only very few companies had availed themselves of it. That Act had an existence of only six months, and possessed little practical value. In 1866, the date of this Company's Special Act, the price of coals delivered at the works was about 13s. 6d. per ton, and it was upon the price of coals at that time that the maximum charge for gas was fixed; and although in the draft of their bill a sliding-scale was prepared, which would have enabled them to increase or reduce the price of gas as coals rose or fell, it became necessary, in order to ensure the safety of the measure, that that provision should be taken out, and the hard and fast line was fixed for a few months at 4s. 6d., and subsequently at 4s. 3d. Coals at 13s. 6d. per ton and coals at 28s. 6d. per ton made all the difference in the prosperity of the company. A great many companies during the past year had been able to increase the price of the gas they supplied, either owing to the fact that they were not incorporated, in which case they had unlimited powers, or that they had an increased maximum price to which, in several instances, they had risen. Many of the companies, even in London, were working at a considerable loss—and London had great advantages over country companies. Only one of the metropolitan companies was in a position to declare a full dividend, and some had been put to the necessity of drawing largely on their reserve-funds. The report of the South Metropolitan Gas Company showed that their expenditure during the last half year exceeded by £19,000 that of the corresponding half year of 1871, while the increased rental had only been £10,000. A hope was held out to them very strongly that during the present session the Government would introduce a measure for the general relief of companies; but, from inquiries they had been able to make in the best quarters, they had ascertained that there was no intention on the part of the Government to pass any measure of relief; companies would, therefore, be put to the trouble and expense of going to Parliament for special amendment Acts, in order to enable them, in justice to themselves and the shareholders, to obtain a fair return upon their investments.

Mr. WARD seconded the motion.

Mr. H. S. GOODY said unless the company got additional powers there was no prospect whatever of their having any dividend next year. In his opinion they could not have a better time than the present in which to represent the injustice of the present system and the necessity for alteration. With regard to the management of the affairs of the company, they must all be highly satisfied with it. No doubt it had been an anxious time for the directors, to whom the shareholders were much indebted, and particularly so to the chairman. He rose for the purpose of allaying any apprehension which might be entertained by shareholders at a distance who had a large interest in the affair, and who, seeing that the working yielded no dividend, might be seized with a panic and hastily dispose of their shares, by pointing out that there was a sum of £3321, so that at present the undertaking, though not profitable, was safe. If they succeeded in getting an Act of Parliament things would go on well with the company, and they would be able to give as good a dividend as in former days.

Mr. ROWAN inquired whether the sum of £7900 paid for coals represented the same tonnage as in 1872?

Mr. TITCHMARSH, an accountant who had been called in by the directors to examine the finances of the company, said there were no accounts of the tonnage of 1872; but, so far as he had been able to ascertain, the coals consumed last year exceeded the quantity used in any previous year.

Mr. ROWAN said he noticed that the expense of purification was a little more than 100 per cent. in excess of any previous year.

Mr. CATCHPOOL said in the previous year the complaints made as to the quality of the gas were so frequent that it became a great anxiety to the directors as to how it was to be remedied. During the past year the quality of the gas had given general satisfaction, and the number of complaints had been very few.

After some further remarks, the motion was put and carried, and the retiring directors and auditor were re-elected.

On the motion of Mr. GOODY, seconded by Mr. KENT, it was resolved—"That in case no measure be proposed by the Government during the present session for the general relief of gas companies, in consequence of the increased cost of coal, the directors be requested to call an extraordinary meeting of the shareholders for determining upon an application to Parliament for an amended Act with reference to the maximum price to be charged for gas."

The proceedings closed with votes of thanks to the chairman and the directors.

BRITISH ASSOCIATION OF GAS MANAGERS.

(*Continued from page* 913.)

Mr. G. ANDERSON (London) read the following paper on

PURIFICATION OF GAS.

As indicated in a letter which appeared in the JOURNAL OF GAS LIGHTING a short time ago, I propose now to bring under your notice some suggestions on the purification of gas.

I am induced to do this for several reasons, among which I may mention that frequently when I am asked to report to gas directors on the condition of their works, I find it takes sometimes several years before they are induced to enlarge and improve the purifying apparatus, although I prove to them, to my own satisfaction, that the matter requires immediate attention, and in an economical point of view would pay to do it at once. I therefore conclude that many of you find the same difficulty.

I also find considerable differences of opinion to be held on the subject as to the best means of doing it, and if I give you my views I may elicit yours, and from these we may mutually improve each other, if those of you who have had the largest opportunities will favour us with your views on the question.

I look, therefore, with more value to the discussion that may follow the reading of this paper than to the paper itself, for we have among us many gentlemen who, from a variety of reasons, have of late years given a great deal of attention to this subject, and with ample means of arriving at correct results, which I am sure they will be glad to make known for the benefit of the members of this society.

I know that of recent years proposals have been made, and also trials have been made, of commencing the purification of gas in the retort itself—or, at all events, of placing substances in the retort that would produce certain combinations that would render the after purification of the gas more certain.

Without, however, throwing any discredit on such attempts, I propose to commence with the gas as we find it in the hydraulic main, and the first question that arises is, what do we find there?

We find a portion of the carbon of the coal in the form of tar as a liquid, another portion of the carbon in the form of permanently elastic gas; the hydrogen, nitrogen and oxygen of the coal we find in the form of ammoniacal water, and all impregnated with other compounds, which originally formed part of the coal; but for our purpose we need only mention nitrogen, carbonic acid, and sulphur, all of which are injurious to the gas which it is our business to manufacture, and which should be removed as far as possible, consistent with not destroying the illuminating power of the gas, before we issue it to the public.

Now, seeing that we have both an acid and an alkali to remove (and we know that such bodies have a strong affinity—or, if I may so express it, a desire to combine with each other), it follows that, if we will only leave them together long enough, they will leave the carburetted hydrogen, which they love not so much, to pass on alone, while they tarry behind, forming that combination which is the quality of their nature.

Thus far, however, this is on the assumption that the proportions of each are present to the other as will allow them, as it were, to "pair." This seems, however, not to be the case, and it is no surprise that it is so, for although nature did form that beautiful combination which we have begun with—coal—in our more clumsy operations we know that much of the carbon has been left behind in the retort. Therefore, as the whole of the substances which formed the original combination are not present, it is no wonder that a perfect union, suitable to our purposes should now not take place, and therefore it becomes our duty to present substances to the gas that will relieve it of those detrimental elements before mentioned.

But you will see that if we would make the most of the several elements themselves, it is wrong to separate them sooner than can be avoided.

The formation of the coal—first in the vegetable structures of which it is composed, and after in the great overlying rock-press of the earth—may have taken thousands of years, during which the most inert substances had time to arrange themselves, while we, by excessive violence of heat, have torn asunder in a few minutes that which nature took thousands of years to bring together. How necessary, then, that we should allow all the time permissible, after this sudden and violent revolution, for the substances to get together again, when we know that in doing so we can get rid of such of them as we do not want.

Now, keeping these principles in view, the first error that we sometimes find is that the gas is taken off at the *top*, while the liquids are taken off at the *side* of the hydraulic main, destined never again to meet, or if to meet again, the union is made at the cost of mechanical pumping power.

Now, carbonic acid, which it is most important to get rid of, passes off with the gas, so does sulphur, but if you were to leave all to pass off in one pipe from the *side of the main*, and travel together till they arrived at the outlet of the condenser, you would find that the ammoniacal liquor, which in the hydraulic main is only of 2 to 3-ounce strength, would when it got to the outlet of the condenser be of 8 to 10-ounce strength—*ergo*, it is wrong to ever take gas off from the top of the main.

By the same reasoning it seems wrong to have vertical condensers, for water cannot travel vertically unless in a downward direction; but in a horizontal condenser the water is rolled and pushed along by the force and contact of the gas, and as the water increases in strength it purifies the gas.

At the Dover Gas-Works, which I constructed ten years ago, our condenser consists of a pipe passing off from the side of the hydraulic main along the inside of the retort-house, then along the other side of the same wall—this time in the coal store—thence it crosses to a water-tank, which forms the roof of the engine and exhauster house. The pipe passes through the water in this tank, into which water is being constantly pumped for the supply of the works; hence the temperature is pretty uniform—a condition which I consider of some importance to the proper condensation of gas.

This pipe is of 10 inches diameter, with 234 feet of it under cover in the retort-house and coal store, and 103 feet of it in the water-tank, and our winter hourly make is about 17,000 feet. The temperature of the gas at that time is—hydraulic main, 112°; inlet to water-tank, 70°; outlet, 58°, where it enters the washer, the atmosphere at the time being 49°.

In my case I have a washer charged with ammoniacal liquor, so that it is of little or no importance whether the condensation up to this point has been perfect, because any tar remaining in the gas will be extracted in the washer; but, suppose some of you have a deficient condenser, and no washer, your object will not be best gained by extending its length merely, but by adding a large box, similar to the drawing on the wall, so that the gas may come to comparative repose before entering the scrubbers or purifiers, and in that box have time to deposit impurities which are now only carried along by the force of the current.

A box of this kind may also be made contributory to mere condensation by keeping the pipes which pass through it open or plugged up, as may be found necessary from the temperature of the gas.

Doubtless you have noticed tar in the lower layers of the purifying-boxes, or in the lower strata of the scrubbers, while the temperature of the gas at the outlet of the condenser was sufficiently low to have condensed it; but, if you consider the speed at which the gas passes along the comparatively small pipes of the condenser, you will not be surprised that condensed matter is carried along with the gas into those vessels, where, from their much greater area, the speed of the current of gas is much reduced, when deposition of condensed matter takes place.

You will find this matter referred to in one of the reports of the gas referees, and also in some remarks of our present president on a former occasion.

It follows from the foregoing that I prefer a condenser made of ordinary pipes, laid nearly in a horizontal position, and all the impurities of the gas carried along with it, and at last deposited in a settling-box. Therefore, I do not think so much of other forms of condensers which we sometimes see, and especially those large flat rectangular boxes into which the gas enters at one corner at the bottom, and passes out at the upper disgonal corner, or those in which an empty scrubber is employed; because, in such cases, I consider the gas is separated too soon from the tar and ammoniacal liquor.

Moreover, a condenser made of ordinary pipes can be provided at from one-half to two-thirds the cost of that of any of the other forms I have mentioned. Besides, there is no reason why a horizontal condenser may not be kept at a height of 10 or 12 feet from the ground. Thus we are enabled to deposit the tar and ammoniacal liquor in a cast-iron over-ground tank, from whence it can be sold or used without the necessity of pumping, and only the surplus allowed to descend to tanks in the ground.

The gas having now parted with all the condensable vapours, we have now to deal with those impurities which require chemical rather than mechanical action for their removal, and in most modern works a series of scrubbers is what we next find.

So much on scrubbers is to be found in previous transactions of this society, that I will not take up your time by any description of them, but at once enter on the more debateable ground of my objection to their use at this stage of the manufacture, and with just that amount of hesitation which every man should feel who has to speak of a matter which is merely an opinion in his mind, and which he has not yet had sufficient opportunities to reduce to the indisputable position of ascertained facts—of my entire objection to their use, and the substitution of washers in their stead.

My objection to their use at this stage of the manufacture is that it is difficult, perhaps impossible, to always ensure, under variations of temperature and quantity of gas being made, and it may be different qualities of coal—to ensure that the condensation of the gas has been perfect at the outlet of the condenser, and that no tar shall enter the scrubber; for I suppose it is admitted that tar in the scrubber is a nuisance.

We know that several schemes and many substances have been employed in scrubbers to lessen the difficulties arising from the presence of tar, and that it is a common thing for scrubbers to be cleaned out every year solely on account of the material being choked with tar. One reason, therefore—but by no means the only reason—why I prefer to use a washer at this stage instead of a scrubber is that tar getting into it does not do any harm; that is, it does not clog up the material in the washer, but runs off through an outlet provided for that purpose.

At Dover we wash before we scrub. The scrubber was put in action in 1865; it is charged with coke, and it has never been cleaned out.

The ammoniacal liquor that has been caught from the condenser in the overhead tank runs into the washer by its own gravity; there is, therefore, no labour attached to it as there is to a scrubber which requires the liquor to be pumped to the top of it.

For those reasons, I say, pass the gas through ammoniacal liquor in a washer before you let it enter the scrubbers.

Now, with reference to the point of washers *v.* scrubbers, we have to consider what is a scrubber.

For the present purpose I describe it as a very large vessel which we fill with brickbats, or coke, or drain tiles, or lastly, deal boards, all bodies that *in themselves are not purifiers of gas*, but merely bodies that are to be wetted with the purifying material, against which the gas is to pass on its way from the bottom to the top; and in proportion as you are successful in getting the material properly and equally wetted, and the gas to take only the properly wetted direction, in such proportion are you successful in purifying the gas.

And the uncertainty of getting all those conditions to coincide exists to such an extent that most engineers find it necessary either to have a series of scrubbers, the gas passing through each, one after the other, or where only one is used, the liquor is pumped over, and over, and over again, before it is brought up to a saleable strength of 12 to 16 ounces to the gallon—namely, to saturate that quantity of sulphuric acid.

Now, the question that I ask is, where is the use of all this trouble and expense to get gas to pass alongside of the purifying material, when we can drive it through it? I also ask which of the two is the most thorough? I also ask you to consider and define your language. Do you scrub?

Is this charwoman's expression correct? In my opinion you merely go a long way round and over many obstacles of your own creating, when you might have taken a straight, direct, short, level cut, and done your business both cheaper and better; and I now proceed to substantiate those propositions.

Cheaper.—A washer that will do as much work as a scrubber can be obtained at one-third of the expense. Why? We do not fill it full of coke or brickbats, which *do not purify gas*, but with ammoniacal liquor, *which does.*

We do not erect a tall structure, that, besides its own cost, requires on some soils an expensive foundation to support it, but a shallow one, which may almost rest anywhere.

We do not require to provide excellent pumps propelled by high-pressure steam-engines, and ingenious mechanically propelled distributory apparatus, which seldom succeeds; but we compel the gas to find its own way through the water in a horizontal direction, and we present such impediments to its passage as cuts it up into fragments, and presents whatever amount of surface we design, and the thing is done.

Better. This proposition is so apparent from what I have already said, that I do not think I should waste your time in arguing it; therefore, before proceeding to the next stage, I will merely state that in my view of a well-designed gas-works there should be two washers placed at such an elevation, the one over the other, that the liquid from the upper one should run into the lower one.

The top one should be supplied with pure water, say 10 to 15 gallons per ton of coal carbonized; the lower one to be fed with its water, and in addition the ordinary ammoniacal liquor of the condenser, and that the gas should pass first into the lower one, thence into the upper one, and on to the "Purifiers," which shall next engage our attention.

But before the gas enters the last purifying vessels, it will be well to go back, and state what we have done to the gas towards purifying it in the vessels we have already had under notice.

In the "washer" and "scrubber," we have already removed a very considerable amount of the impurities.

We have removed in part carbonic acid, sulphur, and ammonia.

Without the washer and scrubber the condenser will produce about 8 to 10 gallons of 10 to 8-ounce liquor. With these vessels, and by the addition of water, as before mentioned, you will produce 20 to 25 gallons of 12-ounce strength per ton of coal carbonized; some people even say more.

Now, in order to estimate the value of this towards purifying the gas we must inquire into the constituents of a gallon of 12-ounce liquor as regards carbonic acid and sulphur.

I find, then, by experiment, that a gallon of such liquor contains about 3600 cubic inches of those gases.

The experiments on liquors of different strengths are as under:—

	Ounces.		Cubic Inches.
Liquor from hydraulic main.	2½	Foul gas, per gallon .	400
Liquor from scrubber. . .	6	„ „ .	1078
Liquor from washer . . .	14½	„ „ .	5000

So as not to overstate it, suppose only 20 gallons per ton of coal; we thus arrive at a total of 100,000 cubic inches. From condensation alone we would have got, say, 10 gallons of 8-ounce liquor producing foul gases, 16,000 cubic inches; or, in other words, we have by washing and scrubbing relieved the purifiers of six times the amount of impurities contained in ordinary gas liquor. The economical effect of this we will find farther on.

The liquor from the hydraulic main we find to contain 400 inches of carbonic acid and sulphuretted hydrogen. This is about 160 inches per ounce of strength.

The liquor from the washer we find to contain 5000 inches. This is equal to 346 inches per ounce of strength; so that, although by an addition of pure water in the scrubber more than equal to all the liquor furnished in the ordinary process of condensation—and which liquor, at 6 to 7-ounce strength, has passed with the ordinary liquor of condensation through the washer—we obtain from that vessel over 20 gallons, of 14-ounce strength, each gallon of which, in proportion to its strength, contains far more impurities than the liquor tested from any of the other vessels—the proportion being as 160 inches per ounce in the hydraulic main liquor to 346 inches per ounce in the washer liquor.

The utility of passing the gas through a washer I consider, therefore, to be fully proved, and I consider its superiority over the scrubber to be equally proved. I shall, therefore, now pass to the purifiers, ordinarily so called.

There are only two substances which the test of experience has fully proved to be available for use in the purifiers—namely, lime and oxide of iron. When I say available, I mean that have succeeded in coming into general use.

The chloride of manganese is an excellent purifying agent, both for sulphuretted hydrogen and ammonia.

With this substance and wet lime purifiers I have purified 50,000 feet of gas per bushel of lime used, but the resulting muriate of ammonia would not be so valuable in most localities; hence, without saying one word against it, I do not, for the reasons stated, propose to deal with it as a purifying agent.

Nor do I propose to touch upon other substances which have been proposed, simply because, practically, I know little or nothing of their commercial value to us as gas manufacturers.

The gas which we have now to introduce to the purifiers still contains a large quantity of carbonic acid and some sulphur, and I prefer now to pass it through the ordinary dry lime purifier.

The gas is now practically purified from ammonia, and has little alkaline action, therefore there is nothing for the carbonic acid to combine with. It is true we might have taken out more of the carbonic acid by further washing with pure water, but likely at the expense of reducing the illuminating power. Thus we consider it better to bring the gas into contact with lime, which has a strong affinity for carbonic acid—a stronger affinity than it has for sulphuretted hydrogen.

If you expose foul lime water from a purifier containing both carbonic acid and sulphuretted hydrogen, you will find that it will absorb carbonic acid and liberate sulphuretted hydrogen, and a skin of carbonate of lime will form on the surface of the water, while the smell of the liberated sulphur may be detected as it is passing off.

Therefore, lime that is already fouled with sulphur, so as to give a foul test with acetate of lead, will still go on absorbing carbonic acid. This fact is dwelt upon very fully in the gas referees report on the sulphur question to the Board of Trade, to which I beg to refer you, but the fact has been long known and acted on anterior to that report.

Keeping that fact in view in working our four purifiers, we do not change the first, or foul one, till the second or third gives a foul test, always having the fourth, or last, purifier clean. When the foul purifier is changed, it is found to be nearly converted into carbonate of lime, and is almost devoid of smell.

It has been suggested that, by this mode of working, I shall keep driving the sulphur forward, and very soon get my gas foul at the outlet of the last purifier.

Such, however, is not the case, which you will readily see when I tell you that we have always the fourth purifier clean.

When the washing and scrubbing are performed as described, and the purifying surface is large, I find that I can purify 18,000 to 20,000 feet of gas per bushel of lime, or the gas of 70 to 72 tons of coal by 1 ton of lime.

A great deal of this success is also attributable to having large purifiers, for here the question of the speed at which the gas is flowing comes into force as strongly as it did in the condensation. And here I must define what I mean by the term large purifiers, that you may not form the same opinion that the referees did when reporting on the sulphur question. They gave out that the purifiers in one well-known gas-works were larger than those of any other works under their charge, whilst the direct contrary was the fact.

My first consideration in the size of a purifier is its superficial content; my second is its depth. On its superficial content depends the speed at which the gas will pass through, and those of you who may have a partition up the middle of your purifier, causing the gas to ascend in the one half and descend in the other half of the purifier, would find a greater benefit by removing that partition and letting the gas pass off in a mere box, than if you were to add another purifier to your series.

On the other hand, any one having a dozen or more purifiers would find it more advantageous to cut up the stream of gas into three, giving four puri-

fiers to each stream; because, in doing so, the speed of the gas would be reduced.

In some large works the speed of the gas is so rapid that it lifts the lime off the trays, and in many works it is impossible to put 3 inches of lime on each tray, on account of the pressure becoming more than the water-lute will bear. What sense, then, is there in calculating the size of those purifiers, when the conditions of their existence prevent them doing the work they were designed for?

In working dry lime purifiers the practice has been to have trays at every 9 inches or so in the depth of the purifiers, on each of which about 3 inches of lime is laid, leaving a space of 4 or 5 inches empty between each layer. I should like to know what these empty spaces were intended for, and what harm it would do to either fill the lime up nearly to the tray above, or reduce the depth of the purifiers by the amount of those empty spaces, and so make them less costly as well as more handy to work.

I know the answer. If you were to put about 9 inches of lime on a tray, you believe it would not get fouled to the extent that it will in a thin layer, and you know that you could not do it, because the gas would blow away at the water-lutes, finding there an easier passage than through the lime.

But all this is because your purifiers are too small. I lay 9 to 12 inches of lime on each tray; in fact, the vessel is nearly filled with lime and trays. I have no excessive back pressure, and the lime is saturated throughout.

I must here remind you, however, that efficient condensation precedes the entry of the gas to the purifiers, and doubtless this is another incidental benefit, as you will find when I come to treat of the economical results.

When the gas referees reported on the sulphur question it appears that they thought that surface was to be measured by the number of trays, or of purifiers, and not by the length and breadth of the vessel; in fact, others have thought so before them, and this induces me to ask you to define in your minds what you mean by the term "surface."

Suppose you had a vessel 10 feet square, you have an area of 100 feet; and suppose you had 6 trays of 3 inches of lime each, you say 6 times 100 equal 600 feet of surface. Suppose, on the other hand, that I had also a vessel 10 feet square, and 3 trays of 9 inches of lime on each, by the foregoing calculation you would give me one-half your surface, while I was employing one-half more lime than you were doing—namely, $3 \times 9 = 27$ inches against your 18 inches. You see, therefore, that our ideas are misleading when we talk in this way, and we must find some other way of expressing ourselves more correctly. Suppose, then, that I have a set of purifiers each 10 feet square, and I am making 200,000 feet of gas per day; I say then, irrespective of their number, that I have a surface of $10 \times 10 = 100$ square feet, and, making 200,000 feet per 24 hours, I have 2000 feet of gas to each foot of surface.

In proportion to the depth of the lime in the purifier, so will be the time that a purifier will last before requiring cleaning out; but I disregard the question of depth when speaking of surface, limiting the latter to the mere area presented to the gas in its passage through the purifier, for by this is measured the speed at which the gas must travel in passing through the purifying material.

I have collected some statistics from my own works, and also from the works of gentlemen who have replied to certain queries that I put to them, with a view to proving the benefit of large purifiers.

I have found it impossible, however, to obtain statistics in which I could absolutely compare one place with another, because in some places stone lime was used, in others chalk lime; in some places the previous condensation, washing, and scrubbing were more or less various. I give you, however, the facts, and you can judge for yourselves, remarking that the best results are invariably associated with the use of the washer.

Table of Coals and Lime used per Annum, Feet of Gas made for each Foot of Purifier Surface, and Tons of Coal purified by each Ton of Lime.

No.	Tons of Coal.	Tons of Lime.	Feet of Gas per Foot of Purifiers.	Tons of Coal purified by each Ton of Lime.	Remarks.
1	9000	150	1250	60	Anderson's washer and scrubber.
2	2407	40	1931	60	" " "
3	2700	60	1930	45	Washer and scrubber.
4	2475	33	1680	75	" "
5	2250	76	2000	30	One scrubber.
6	5850	175	2437	33	Two scrubbers.
7	3600	90	2250	40	One scrubber.
8	3600	88	1000	41	" "

The first four give very good results. The average of the whole is 60 tons of coal to 1 ton of lime, and but for No. 3, which only does 45 tons as against No. 4 that does 75 tons, the average would have been very much over 60 tons. I therefore conclude that the washer at No. 3 is little worthy of the name.

The next four cases do not use the washer; but each uses one scrubber, and one of them uses two scrubbers. The average here is 38 tons of coal purified by one ton of lime, by the use of scrubbers only, as against 60 tons where both washing and scrubbing are done.

On the other hand, the average quantity of gas per foot of purifier surface in the first four cases is 1698 feet, whilst in the latter four cases it is 1922 feet per day, which, according to my theory, is against good results, and this agrees with what we find.

However, if my theory of the great benefit of washing is correct, the purifiers were, according to the work they had to do, much larger in proportion than the relative figures of 1698 to 1922 show, for the gas, before it entered the purifiers, was much purer than in the case where no washing had been done.

It will be observed, however, that in none of those cases is the purifying surface so small as it actually is in many gas-works. The average of the whole is 1810 feet of gas per day to each foot of purifying surface; but in some of the works on which the referees reported, and which they stated, "as regards sulphur purification, the magnitude of the purifiers relative to the make of gas is greater than those employed in any gas-works in the kingdom," for what were the figures compared with those eight cases that I have laid before you?

At one works there were 3000, at another 4200 feet of gas per foot of purifying surface, and at all the other London works the purifying surface was much smaller. Indeed, I know that in some of the London works as much as 5000 to 6000 feet of gas has been made to pass through every foot of purifying surface per day.

Now, to arrive at some idea of what this state of things means, let us suppose that any of you were about to erect works for the supply of 5000 to 6000 feet of gas per day, would it occur to you to provide purifiers only 1 foot square? I am sure it would not, but that you would provide them at least 2 feet square, or four times the size in proportion to the work to be done, and very likely you would even provide them larger than that.

I believe that a great deal of the "hubbub" that we have heard of late years in this metropolis would never have occurred if the purifying surface had been at all adequate; but since gas has become so reduced in price—first, by the introduction of the Great Central Gas Company, from 6s. to 4s., and afterwards, by the legislation of 1869, to 3s. 9d. per 1000 feet—the same attention has not been given to extension of purifiers as to that of retorts. Who is to blame for this, if any one is? I neither know nor care. I merely state the facts as they appear to me. Let those explain, if they like, who know the circumstances. The moral which we should draw from it is, that we should take care that the boards of directors whom we influence are informed in writing of our wants, and, if these are not supplied, let the responsibility rest with them.

The length to which this paper has already extended admonishes me to be brief. I must, therefore, leave the advocates of oxide of iron purification to show us its superiorities over lime.

My experience of it was that it required larger purifiers than lime does; that the purifiers required oftener to be cleaned out; that a large space, at least equal to that on which the purifiers stood, was required as a revivifying ground; that its action was less to be depended on than that of lime; that it was of no use in removing carbonic acid, and therefore I had to use lime as well; that a very considerable amount of smell was given off during revification; that there was considerably more labour than with lime, on account of the frequent turning of the material; and I also formed the opinion that there was a greater tendency to the deposition of crystals of naphthaline. I have seen them covering the interior of the purifier-lids, and also mixed with the material itself, and I found them in the mains and services.

I know that the smell given off by foul oxide of iron is not so obnoxious as that given off by lime when the purifiers are too small; but I think that when these are large, and worked as I have described, there is more smell from iron than lime.

I know, too, that oxide of iron purification is at present nominally cheap, for in fact, while some pay about 2d. per ton of coal, there are others who actually sell the spent oxide for more than they paid for it, reducing the cost of the material to *nil*. I do not know, however, that this takes place unless where a good deal of ammonia can be extracted from the material, and if so, while we may not be paying in money, we may be in kind, for I have found that oxide of iron can absorb a large quantity of ammonia.

The material of purification, whether of lime or of oxide of iron, is not, therefore, one of great expense. The principles that guide the one, I have no doubt, will be found to guide the other, in so far as surface is concerned, giving the material of whichever kind time to combine with the impurities of the gas, and it may be left with engineers to select that which they find the best, all things considered.

Lime has unhappily got into bad odour in the public estimation, on account of the strong odour given off from it when not properly worked, namely, when the surface is too small.

But although the odour, under such circumstances, is not exactly pleasant, I am far from thinking that it is noxious in a sanitary point of view, and the two questions of sulphur in lime and sulphur in gas may here be considered together.

We have for some years been literally bored by what I consider little short of quackery, and in saying so I wish to be precise in my terms.

Where a statement is made based on proved facts, I deem that science; but where the statement is merely an assumption, I call that quackery.

Now, the first assumption in this case is that sulphurous acid, in the infinitesimal quantities that it may exist in gas—say 25 to 30 grains per 100 feet—is an evil. On what grounds has that statement been established? Mind you, I do not stand here to assert any superiority in gas containing sulphur in any quantity, however small; but, should it do so, what then? The only reasons that I have heard urged are, gildings will be injured, and its products are not so congenial for respiration; but it appears to me that, if so, it is the architect that is at fault. It was never, surely, meant that we should inhale sulphurous acid, or carbonic acid either, unless we chose to do so medicinally, and I shall have something to say on this head presently.

If it is granted that I must inhale the products of combustion from gas, it equally follows that I must breathe the respirations and other exhalations which are either passing off constantly or intermittently from the human inmates of the room.

I object to the assumption, and if even I were to grant it, I think that the air that has been sucked in through diseased teeth and lungs, and again sent forth for my respiration, is of a quality more noxious to my senses than the products of gas combustion in pure air. Therefore, I say that any apartment in which people live, or gas is burnt, should be so ventilated that we shall not be required to breathe the air that has perhaps passed in and out of 100 pairs of lungs, or that has even been burnt by the comparatively innocuous gas.

But grant the assumption that we may have to breathe some sulphurous acid. I have never seen any proof, or attempt at it, that, in the infinitesimal quantities to be found in gas, it can be injurious to man in the ordinary conditions of civilized life. I am of quite a contrary opinion, and that a little sulphurous acid is beneficial to mankind.

Need I remind you of the many ways in which sulphur is used as a disinfectant—of its application to trees and plants infected with parasites, of people carrying it about with them for the cure of rheumatism, of new flannel recommended to be worn by rheumatic patients, the beneficial effects of which are said to consist in the sulphur that is used in preparing it?

One of my earliest recollections of gas-works is of children in the whooping-cough being brought to breathe the air of the works when the purifiers were being cleaned out.

Now, I contend that man never establishes any custom that has not in it some element of good. You may overdo anything; but if you find a certain custom or belief established, and more especially contemporary with the spread of science, you may depend upon it that it is worthy of your consideration.

The curative effects of sulphur in the solid form are widespread, and in the fluid and the gaseous form it is now constantly employed.

When the cattle plague raged in Scotland a few years ago, the burning of sulphur in the cow-houses became common, and it was found that not only had the sulphurous acid so produced a beneficial effect upon the cattle, but also on the men who attended them.

Many medical men now prescribe the fumes of sulphur, and also the spray of sulphurous acid, to wounds, and apparatus has been contrived, and may be bought at the chemist's, for the purpose of producing a spray of sulphurous acid.

Lord Bacon, in his "Essays" (Art. "Friendship"), writes: "You may take larga to open the liver, steel to open the spleen, flowers of sulphur for the lungs, castoreum for the brain; but no receipt openeth the heart but a true friend."

From a medical pamphlet published by a practising surgeon in 1868, I will read you just one or two paragraphs.

For diseases of the throat and lungs, including colds, coughs, diphtheria, asthma, swollen tonsils, &c., sulphur is used both in the state of sulphurous acid spray and fumes from burning sulphur.

For all flesh wounds—chaps, chilblains, &c.—it is used in the liquid state, and it is remarked that wounds seldom or never fester when sulphurous acid is applied

Medical men—at least, many of them—are now agreed that most of the diseases I have named are caused by the presence of new life, either fungi or animalcula; indeed, that fevers are also due to a poisoned blood, which poison consists of minute living creatures having found their way into the blood, and, floating through the minutest channels, propagate and multiply until they destroy the vital functions; that the air is constantly full of life; that we are constantly inhaling it; and whether we are struck down by disease very much depends upon the state of our vitals to resist the poison, and whether we have

been placed in a position to receive such an overdose of it as we are unable to throw off.

What more likely, then, but that sulphurous acid in minute doses existing in the air we breathe, and inhaled some fifteen times a minute, and taken direct into the laboratory of the body where the blood is constantly either badly purified or polluted, may not be one of the most beneficial agents in preserving us from the numerous poisons that are constantly produced by dirty habits, overcrowded habitations, badly-drained and ill-ventilated and ruinous tenements, and all the other irregularities and artificialities incident to life in all large cities.

Until I hear stronger reasons urged than I have done for the removal of the last grains of sulphur from gas, I shall hold to my present opinion that this is a matter unworthy of the trouble and annoyance it has cost.

When we know that sulphur in numerous combinations with other bodies has been given as medicine for hundreds of years, why should we jump to the conclusion that infinitesimal quantities of it inhaled should be injurious? Given in the usual form of liquids, it has to pass through the stomach and intestines, and only gets at the blood by a secondary process; but, inhaled into the lungs, it comes at once direct on the other side of the thin membrane of the lungs that divides it from the blood which is to be purified.

From the fact that the death-rate in large towns where enormous volumes of sulphurous acid fill the air is not greater, nor, in many cases, so large as it is in many a country village, I think we may banish all idea of its being hurtful to human beings.

That its smell is disagreeable when undiluted I at once grant—so are the taste and smell of many other things—but, in this case, I contend that there should be no necessity for sniffing it. We should, one and all, assist in carrying out efficient means of ventilation, and never pretend that the products of gas combustion are to be breathed direct from the burner any more than the products of any other fire or light.

You will frequently see gas-stoves advertised that do not require a chimney, and many such are fixed, rooms heated, and all the products of this fire allowed to discharge into the apartment. Of course, all this is folly; and that such gas-stoves can be permitted at all proves, in my opinion, the great purity of the gas.

I have now done. On a subject of this kind, where there is such variety in practice, there must also be variety of opinion. As we are all interested in arriving at a just estimation of what is best, we can all, I hope, afford to have our pet theories ventilated; by which the mental combustion will be the most perfect, and give off the smallest amount of disagreeable products.

In the pages of the JOURNAL OF GAS LIGHTING and elsewhere several authorities have commented on the various ways of conducting the lime purifiers. I have not thought well to discuss those, preferring that you should hear from the lips of the advocates themselves their own statement of their own modes, which they will be sure to give correctly and more concisely than I could do, and who, besides, are better able to explain to us the advantages which they have found to follow. Thanking you for the attention you have given to, I fear, a too long paper, I leave the subject in your hands.

The PRESIDENT remarked that the writer had presented an exceedingly able, interesting, and exhaustive paper, and he felt certain that the facts and arguments brought forward would appeal to the common sense of most of those who had heard them.

Mr. WATSON (Sydenham) said it seemed to be a thousand pities that they could not get parliamentary committees to adopt Mr. Anderson's views in reference to sulphur. Having recently been obliged to supply gas with not more than 20 grains of sulphur in any form in 100 cubic feet, he had been compelled to discuss this question, and he was bound to say that he never in his life heard a paper on the point which he so thoroughly endorsed as that to which they had just listened—except as to one matter—viz., that of carbonic acid. He thought he understood Mr. Anderson to say the more of this they took out the greater would be the illuminating power of the gas. He believed the president had taken a step in that direction, and he himself had also done so, and they had each obtained the same results by different means. On that very morning he had tested the gas at his works, at the outlet of the washer, and it took five minutes to colour the lime water. He inferred from Mr. Anderson's remarks that the more mechanical purification could be adopted before the gas reached the purifiers the better. Working in this direction, he had succeeded in obtaining gas with from 10 to 15 and 17 grains of sulphur per 100 cubic feet. He apprehended that the days of scrubbing were past, and that the sooner they turned their attention to washing the sooner would they arrive at the time when they would be able to comply with parliamentary obligations at a small and trifling cost. With reference to purifying area, he knew that some persons estimated it by cubing the contents of the purifiers. He quite agreed that they should adopt some standard. He made his purifiers 2½ square feet for each 1000 feet made in 24 hours, and he had lately decided to add about one-third of to that. The larger surface they made their purifiers, and the larger the area of purifying space, the more efficiently would they purify their gas.

Mr. TRAVERS said at the Cork works they used Mr. Anderson's system of purifying. They had two stations in Cork, at one of which they purified with wet lime purifiers 15 feet in diameter. Previous to 1873 they had four dry lime purifiers, 9 feet by 7 feet, at the other works, and in the winter of 1872–3 they were obliged to make four, six, and even eight changes in the 24 hours, and were compelled to have men day and night, and work against a back pressure of 30 inches. Mr. Anderson was then called in, and by his design they erected in 1873 four large purifiers, 36 feet by 18 feet, a washer and a scrubber. At the commencement of this year they were in a position to put the new purifiers into action. When they charged them at first with lime, they charged them with 3 inches thick in three layers and 6 inches on two layers, and passed 3,760,000 feet of gas through them. The next time the lime was 6 inches on three layers and 10 inches on two layers, in all 38 inches, and then they passed 7,500,000 feet of gas. The next change was to place lime 10 inches thick on four layers and 12 inches thick on one layer, in all 52 inches, and pass 10,600,000 feet of gas. He might remark that the lime was thoroughly saturated from the large layers. A professor of chemistry at Queen's College, Cork, had made an analysis of the lime, and he had furnished a statement in which he gave the results of his tests, and declared that there was no free lime in it. Now as to the question of pressure, he had before stated that formerly they had to work against a back pressure of 30 inches; now it was only 12 inches, and 2 inches only of this was due to the purifiers, even when passing 33,000 feet an hour through them. They found that with £280 worth of lime they could do as much work now as they did formerly with £450 worth, and they also found that the reduction of the labour was 50 per cent. for the purifiers. They next found that wear and tear and cost of engine power was less, and that in fuel there was a considerable reduction. In residuals there was an increase of 40 per cent. in the shape of sulphate of ammonia. The water passed into the scrubber at the rate of 10 gallons per ton, and he had had it 7° Twaddel, or 14° liquor. He was moreover convinced that continuing the use of Mr. Anderson's system they would be able to show better results at the end of another year.

Mr. HISLOP (Paisley) said he had given some little attention to the subject of purification, and for many years was in the habit of acting on what were esteemed the best rules for calculating the area of purifiers. His experience was that the best of them were utterly inadequate for the purpose required. About seven years ago he devised a new rule—viz., that of two superficial feet of area per 1000 cubic feet of gas per day to be purified. He utterly disregarded the tray surface, holding that that had nothing to do with the area in the purifier. He never would, in any case, employ more than two trays, or at most three for lime; indeed, his own practice was two for lime and one for oxide, and he believed this was in accordance with Mr. Anderson's view. Why should they have an interval of space of 6 or 7 inches between the trays? He held that the true theory was to calculate the area of the purifier and disregard entirely the area of the trays. By increasing the area and diminishing the velocity they would increase the power. In Paisley, at the works he represented, the make of gas at midsummer was about one-fifth that of midwinter, and he found that with the same area they purified 500 per cent. more gas at the former than at the latter period. He was therefore inclined to think there should be 6 superficial feet of area for every 1000 cubic feet of gas per day. It was unfortunate that in all the rules published no reference was made to the amount of impurity in the coal gas, and he attributed the difference which existed in opinions on the subject to this fact. The rule which would be quite adequate in one place might not be in another.

The PRESIDENT: In calculating 2 feet per 1000 do you take the area of the whole of the purifiers in the set, or only of the first one?

Mr. HISLOP: The whole of them.

The PRESIDENT: Then you think 6 feet should be the area?

Mr. HISLOP: Yes; I have two sets of three purifiers.

Mr. METHVEN (London) asked what was the size of the washers per 1000 feet, also whether an increase in the temperature of the gas altered the requirements. Was it necessary to bring the gas down to 58° at the inlet of the depositing vessel, and whether that vessel further reduced the temperature. Did Mr. Anderson consider it was absolutely necessary to use this box?

Dr. STEVENSON MACADAM (Edinburgh) wished to make a remark on a point more in science than in actual practice, which the reader had brought forward. He (Mr. Anderson) seemed to consider that, so far as regarded the pollution of gas-works, it might be advantageous to have them placed alongside of our convalescent hospitals, and that it would conduce very much to the health of towns if there were more of these health-giving manufactories distributed in our populous districts. He (Dr. Macadam) thought this idea had arisen from a little difficulty in distinguishing between the various forms of sulphur. The writer of the paper seemed to think that the gas evolved from spent lime was sulphurous acid, such as had been used in considerable quantities as a curative agent. But, of course, it was well known that the hydrosulphuric acid and the sulphuretted hydrogen which was evolved in the manufacture of gas were of a totally different character to the acid given off by the combustion of sulphur. He dared say that if they were allowed to set fire to the gas lime, and convert the sulphur it contained into sulphurous acid, there might be some benefit derived; but, so long as it remained sulphuretted hydrogen, he was afraid they could not anticipate much good from the curative properties of gas-works. He did not exactly understand what the writer meant to convey by his remarks about the use of sulphurous acid, and had made these remarks so that in his reply he might clear up any little misapprehension on the point.

Mr. BATES (Worksop) said he could never thoroughly understand why gas managers showed an inclination to have only 3 inches of lime on their trays. He thought, as a rule, the thicker the better. He had five trays in his purifiers, which were 10 feet square. He began with 6 inches and had increased to 10, and, from what he had now heard, he was inclined for the future to work with only two tiers, and to put the lime on thicker.

Mr. METHVEN (Bury St. Edmund's) said he did not use Mr. Anderson's washer, yet he thought he obtained as good results as that gentleman did. In one gas-work, which was under his own control, some time ago, he had a scrubber 16 feet high and 4 feet 6 inches in diameter. At the bottom was a bell which caused the gas to dip into ammoniacal liquor. The remainder of the scrubber was filled with brickbats. He erected a force-pump, driven by an engine, and passed the liquor through the scrubber. The result for one quarter was 20 gallons of 13-oz. liquor per ton, which he thought was about what Mr. Anderson obtained. He had compared these results with those obtained by a friend, who had a scrubber as high as the tower of Babel, but who only obtained 10-oz. as against his 13-oz. liquor. He had since used oxide of iron, and though Mr. Anderson was rather careless in the matter of sulphur, he might state that, on analysis, his spent oxide contained 56 per cent. of sulphur, also about 10 per cent. of sulphate of ammonia. In another gas-work with which he was connected, and where he used lime, with a scrubber in the usual fashion, he was able to get 13-oz. liquor, but there was not so much of it. He believed the absence of washing there had something to do with the poorer results. In the winter time he purified 7000 feet of lime to a lime-burner's bushel, and in the summer time 9000 feet.

Mr. HUNTER (Rochdale) wished to make a remark as to the comparative cost of oxide of iron. He could not admit that purification by lime was cheaper, so far as labour was concerned, than by oxide. In fact, in his own experience he found the lattter was less, and he believed there were many gentlemen present who could also state the same. With regard to the cost of material, of course circumstances must, to a great extent, alter the case. For instance, he had had experience in an agricultural district where the foul lime was somewhat valuable, and fetched a very good price. At the present time, his experience was in a manufacturing district where they had to pay a very high price for lime, and the waste was almost worthless. He found they could almost entirely purify with oxide, and the cost was *nil*. He required a little lime, certainly, to take out the carbonic acid; but if he could do most of the work with an article which cost nothing, and with which the labour in the purifiers was less, it must follow that oxide was cheaper than using lime altegether. When he went to Rochdale he found that the mode was to carry off the tar and liquor from the side, and the gas from the top of the main, and he was so convinced that this was an imperfect system that he adopted the very plan which Mr. Anderson had recommended. He found there was sulphide of ammonia formed in the passage from the hydraulic main, and that must reduce the objectionable sulphur compounds which were made too much of as impurities. Although scrubbers had been so much spoken against, he found that he could get the same results by their use that Mr. Anderson obtained by other means. He could get 30-ounce liquor, though, of course, not so much per 1000 cubic feet, by scrubbing. No doubt, when they got anything above 18-ounce liquor there must be much sulphuretted hydrogen and other impurities present in it.

Mr. WOODALL (Burslem) said Mr. Anderson's paper was based very largely on the assumption that the presence of sulphur in purified gas was not an obnoxious thing. Parliament said it was, and he (Mr. Woodall) quite agreed with Parliament. Mr. Anderson also put a good deal of the blame upon the architects for contributing to the nuisance of which people complained; but it must be borne in mind that gas managers had to do with houses as they were, and there could be no question that there was good ground of complaint sometimes. It was frequently a beastly nuisance, and for his own part he was sometimes ashamed to go into the houses which they supplied with gas. At Burslem, however, they had done as much as any people in the provinces with a view to the extraction of sulphur from the gas, and they had a system of purifiers which was certainly very complete. They had one to deal with the carbonic acid only, and three others (with the ordinary centre-valves) to deal with the sulphide of carbon. They had purified 300 feet of gas to the foot of lime, and were now increasing the quantity of lime, but up to the present time he did not see any material improvement. With all this purification, the sulphur in Burslem would sometimes run up as high as 70 grains per 100 cubic feet; ordinarily it was from 15 to 20. Why it was so much in excess at times he had never been able to make out; but he believed it was due to the escape of carbonic acid from the first purifier. Mr. Watson told them that at the outlet of his purifier gas did not discolour lime water in five minutes. He (Mr. Woodall) had found the same, but notwithstanding there was a great deal of carbonic acid present. He knew at Beckton the gas

was first freed from sulphuretted hydrogen before the carbonic acid test was applied. At Burslem the coal obtained in the district varied so much that he had no data to offer in respect of sulphur. At one time he could pick out 5 per cent. of pyrites, and at another time the coal was comparatively free. But he believed the Staffordshire coal had three or four times as much pyrites in it as Newcastle. At Newcastle-on-Tyne they obtained the best results as far as sulphur compounds were concerned, and there, of course, they had the pick of the coal. But there was this remarkable thing to be observed—that clean lime was ineffective for sulphur purification. If in their anxiety they changed their purifiers too frequently, they would find the proportion of sulphur in the gas invariably increased. The longer they could keep the sulphide of lime exposed to the gas, the purer the latter would be. Almost invariably the putting on of a clean purifier would increase the amount of sulphur 25 per cent.

Mr. PATERSON (Warrington) expressed the pleasure with which he had listened to the paper. Mr. Anderson might be regarded as one of the best authorities on the subject of gas purification; he had given great attention to it for many years, and was thoroughly acquainted with it in all its details. The paper just read by him was of great value, and would be perused with much interest by every member of the association.

Mr. VERNON HARCOURT wished to say a few words on the point raised by Mr. Anderson, as to the proper mode of estimating the quantity of lime a purifier contained. It did seem erroneous to speak of the purifying area simply. There were really, he thought, two quantities to be considered—one was that upon which the length of the contact of the gas with the lime depended, and this was, no doubt, the cubic contents of the purifier; not by taking the whole size of the box, but the area of the lime, and the total depth of the lime in each purifier. Upon the area depended, of course, the amount of force required to send the gas through the lime, and the unit required was the number of cubic feet used in the purifier-box per 1000 cubic feet of gas per hour. It must be a unit of that kind—the quantity of lime for so much gas passed. In proportion as that was greater would the effect of the purifying be—the lime more thoroughly used, the gas more thoroughly purified. The practical point in the paper was the recommendation to have large boxes. He (Mr. Harcourt) thought there was no doubt Mr. Anderson was right, because with large boxes the lime was more thoroughly used, and less force was needed.

Mr. MEAD (Reigate) said he thought they must all feel very much indebted to Mr. Anderson for the valuable paper he had contributed, as it was full of useful information. Some of the friends did not, however, appear quite to understand what the writer wished to convey, and Dr. Macadam would, he thought, find Mr. Anderson referred to sulphurous acid after, and not before, the combustion of the gas. Mr. Methven condemned tall scrubbers, which he said were now being made as high as the tower of Babel. He (Mr. Mead) did not aspire to anything so lofty, but he was having one made 50 feet high, from which he hoped to obtain good results. With reference to the area of purifiers, it should be clearly understood that the area of one tray of the smallest purifier the gas had to pass through was the area or purifier surface to be calculated, so that if the smallest purifier was 12 feet square inside, then the area of purifier surface was 144 square feet, irrespective of the number of trays in such purifier. He thought they would all agree that it was desirable to remove as much sulphur as possible from the gas; at the same time he believed the outcry about sulphur had been carried to a ridiculous extent; indeed, if all they heard was true, it must be prejudicial to health to light a lucifer-match in a living-room. They must all feel convinced that these meetings were calculated to promote the science of gas lighting. At present they were trying to arrive at the same results by different means, but there could be no doubt there was some one plan better than the rest, and these discussions were calculated to lead them to it.

Mr. ANDERSON said a great many gentlemen had spoken so favourably of what he had advanced in his paper, that he did not think he should find much to reply to. Mr. Watson remarked in effect that the scrubbing era was about expiring, and the washing era beginning. That was a point upon which he (Mr. Anderson) would like to have given a few minutes, but he would only now say that he entirely concurred in the observation; and he believed more than that—he believed they were approaching an era (and it would depend very much upon gas managers themselves whether it should be inaugurated more or less speedily) when all the gas would be purified without lime purifiers—when it would be done in closed vessels, and they would not have to take off the lids. He regretted that Mr. Patterson was not present on this occasion, the more especially as his absence was attributable to ill-health. Mr. Patterson and he had had a friendly growl at each other in the JOURNAL OF GAS LIGHTING, and he (Mr. Anderson) had read one or two pamphlets which Mr. Patterson had published. He was bound to say—in the absence of that gentleman, and premising that he had never seen him—that he believed that Mr. Patterson understood more about the purification of gas than any one present did, and he was much obliged to him for having written the pamphlets to which reference had just been made. Mr. Patterson was on the same scent as himself—the purification of gas by liquid processes, which would be self-actuated. He was satisfied that the object to be arrived at should be the perfecting of a system of purification in closed vessels, and his experience led him to think there was every probability of success. Mr. Travers gave a description of his process at Cork, which seemed to be very favourable. He proved that, while using the ordinary quantity of lime on a tray, he purified 3 millions with each purifier; but he had gone on increasing the thickness of lime until he now purified 10,600,000 in each purifier. He also showed (that which, perhaps, might not strike attention at the time) that he had only two inches of pressure over the whole of his purifiers. Hr. Hislop proved what he (Mr. Anderson) had always found, and which the late referees did not find, when they reported on sulphur purification. They stated that, though only half the quantity of gas was made in the summer as in the winter, they did not find any benefit—*i.e.*, there was as much sulphur in the gas at one time as another. Now, all he (Mr. Anderson) could say was that, if such was the case, they did not know how to work their purifiers, for it was a fact that, with a large surface and a summer make of gas, the passage of the gas through the lime was much slower, and this was a great point, for much depended upon the speed of the gas through the purifier. The area of the vessels, and not the number of vessels, was the point for consideration, and he would say to managers, "Have your vessels large enough, and do not calculate the whole of the vessels, but calculate one vessel—that is, the area your gas has to pass through. It does not go through all the purifiers at one time, but each purifier in succession; and, therefore, the area of one purifier is the measure of your purifying capacity." Then as to what should be the unit. The unit, in his opinion, should be this—he did not at all complain if there were 2000 feet of gas a day passing through one purifying foot of space, but if there was only 1000, so much the better. When the gas was rushing through the lime, and lifting it off the trays, as it sometimes did, it had no time to combine and be acted on. Mr. Methven gave them the results of his experience, and stated that though he did not use Anderson's washer, he obtained as good results. Very likely. Mr. Methven was very clever; he would be sure to get good results, and he wished him continued success. He was much obliged to Dr. Macadam for pointing out what he thought was an error in the chemistry of his paper. But he (Mr. Anderson) never stated that sulphuretted hydrogen was sulphurous acid. He knew how it could be made into sulphurous acid by the heat of fire; but at the time he was speaking of combustion, as Mr. Mead pointed out. He did not mean to assert—because he did not believe—that the sulphuretted hydrogen passing off from lime purifiers was nice stuff; but he was not quite sure that even sulphuretted hydrogen was so very noxious as some people supposed. It all depended upon the way it was produced. The same effects might be produced chemically by different means, and different results might be produced from the application of those effects. He had given an instance. The foul gases from a close sewer were very noxious, and there was evidence that they produced disease. What was contained in the sewer? The same as in many a country dung-heap; but in the latter case the matters were not closed up—not put, as it were, into a retort. The same substances, under different circumstances, would not produce the same results. At the beginning of the year, in Ireland, the space in front of the cottage-doors was occupied by the dung-heap, 3 or 4 feet thick, and the children were running about there with the pigs, while the fumes from the heap filled the house. But there never was a healthier or happier lot of people than the Irish! As to locating convalescent hospitals near gas-works, all he could say was that if there were a number of asthmatic patients in a hospital they would be decidedly improved if there were gas-works in the neighbourhood. Mr. Hunter spoke about the strong liquor he obtained from his scrubbers. He should like to ask that gentleman whether he pumped over and over again.

Mr. HUNTER: Only once—from pure water.

Mr. ANDERSON said in that case it must be well scrubbed. Mr. Woodall remarked that the Act of Parliament called sulphur in gas obnoxious. He (Mr. Anderson) did not say it was not; all that he contended for was that its extraction was not worth the trouble. Take it out by all means if it could be done; it was not done now, and he maintained that it was all an assumption that people were injured by the quantity ordinarily present in it.

Mr. WATSON remarked that Mr. Anderson had given them to understand that it was advantageous to retain a portion of the carbonic acid.

Mr. ANDERSON, on the contrary, said, "Take it all out before you get to your lime purifiers." The process he was going to try would have that effect.

The PRESIDENT said it devolved upon him to sum up the discussion. He was bound to admit that washers were undoubtedly preferable to scrubbers in all points, except as to pressure. No doubt, by passing gas through the water or liquor, there was a more effective action than by its merely passing over a wet surface. If washers could be so adapted as to obviate the increased pressure, they would be far better than scrubbers. Hitherto a great deal had been done by means of scrubbers, and a gentleman now present, Mr. W. Mann, and others, had succeeded in removing the ammonia absolutely by means of scrubbers, without pressure, where they were fitted up with thin boards, giving excellent results. As to the size of purifiers, there was no doubt whatever that in many small works the size was comparatively much greater than in large works. The rule seemed to be with gas companies as with railways—the progress of business had far exceeded expectations, and the increase had come upon them so rapidly that it was difficult to overtake it. They erected additional purifiers, and at the moment considered them to be sufficient, but by the time they were finished, it was found that they were not large enough to meet the growing demand for gas. He felt persuaded that they were not at all likely to err on the side of over capacity. The more extensive they could make the apparatus the better. He was glad to hear Mr. Harcourt take part in the discussion, and especially glad to find him present to hear what was said, for Mr. Harcourt was interested largely in this matter, and was doing all he could to facilitate the removal of sulphur by less objectionable means than by the use of lime. He (the president) sincerely hoped that Mr. Harcourt and the gentlemen associated with him would be successful in their efforts, which would confer a great boon upon gas managers. Far be it from him (the president) to advocate the presence of sulphur in gas; but he must agree with Mr. Anderson on this point, for he did not believe that the public outcry as to its injurious influence on the human frame was sufficiently founded on facts to be received as truth. It might injure brasswork, but he did not believe the small quantity which at the utmost was ever found in purified gas as supplied by gas companies could have any effect upon bodily health. In gas-works those who were necessarily engaged in the manufacture breathed plenty of sulphur, but, as a rule, the workmen enjoyed as good health as any class of men in the community. Mr. Woodall, of Burslem, said that at his works the quantity of sulphur sometimes increased to 70 grains per 100 cubic feet, and certainly if present in any such quantity it would be perceptible to the taste, and he believed Mr. Woodall said it could be tasted in a room where it was burned. In using oxide of iron for purification, there were never 70 grains of sulphur present; 40 grains used to be the outside quantity. He might venture to tell Mr. Harcourt that though gas managers had been a little worried about this sulphur question, they were desirous of doing all in their power to remove all causes of complaint, and he believed that before long Mr. Harcourt and his coadjutors would be able to fix a maximum which it would be quite possible for gas companies to comply with, and that would satisfy Parliament and the public. He agreed almost entirely with all that Mr. Anderson had stated, and he earnestly commended the paper read by him to the thoughtful consideration of every member of the association. He mentioned caustic ammonia, but ammonia in that state did not affect the sulphur compounds to any perceptible extent. It would remove carbonic acid and sulphuretted hydrogen, and would probably become a most valuable purifying agent.

(*To be continued.*)

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the composition and quality of the metropolitan waters in June, 1874:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness.	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	17·17	0·066	0·086	0·002	14·0	3·3
West Middlesex	16·73	0·051	0·098	0·001	14·0	3·3
Southwark and Vauxhall	17·53	0·056	0·089	0·002	14·3	3·8
Chelsea	17·31	0·082	0·098	0·002	13·5	3·3
Lambeth	17·19	0·060	0·100	0·003	14·0	3·5
Other Companies.						
Kent	27·03	0·003	0·246	0·000	21·0	5·6
New River	16·54	0·019	0·088	0·000	13·6	3·3
East London	16·58	0·051	0·123	0·001	13·5	3·5

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was more or less turbid—namely, in those of the Lambeth, the Southwark and Vauxhall, and the Grand Junction Companies. The average quantity of water supplied daily to the metropolis during the preceding month was, according to the returns of the water companies to the Association of Medical Officers of Health, 121,281,889 gallons; and the number of houses supplied was 510,033. This is at the rate of 35·7 gallons per head of the population daily. HY. LETHEBY, M.B.

The Registrar-General publishes the following returns of the average daily quantity of water supplied by the London water companies during the month of May, 1874. According to these, 121,281,839 gallons, or 551,039 cubic mètres of water (equal to about as many *tuns* by measure, *tons* by weight) were supplied daily; or 237·8 gallons (108·0 decalitres), rather more than a *ton* by weight, to each house, and 33·5 gallons (15·2 decalitres) to each person, against 32·4

gallons during May, 1873. According to returns of the London water companies made to the select committee on East London Water Bills (session 1867), it is estimated that, during the year 1866, about 82 per cent. of the total supply of water for all purposes was for domestic use. Applying this proportion to the total quantity supplied daily in the month of May, 1874, it may be estimated that about 99,451,108 gallons were used for domestic purposes, or about 27·5 gallons per day for each inhabitant, against 26·6 in the corresponding month of last year. This proportion varies from month to month, but the Registrar-General has no means of giving a more exact estimate.

Companies.	Number of Houses, &c., supplied in May., 1873.	May., 1874.	Aver. Daily Supply of Water in Gallons* during May., 1873.	May., 1874.
Total supply	503,562	510,033	115,893,425	121,281,839
From Thames	235,854	239,673	60,520,925	63,076,863
„ Lea and other Sources	267,708	270,360	55,372,500	58,204,976
THAMES.				
Chelsea	28,270	28,395	8,442,800	8,648,000
West Middlesex	44,690	45,754	9,644,036	10,062,205
Southwark and Vauxhall	79,236	79,638	17,786,818	18,850,300
Grand Junction	34,243	35,144	12,290,271	12,135,958
Lambeth	49,415	50,742	12,357,000	13,380,400
LEA AND OTHER SOURCES.				
New River	121,135	122,121	25,369,000	28,584,060
East London	104,637	105,562	23,312,600	22,493,200
Kent	41,936	42,677	6,690,900	7,127,776

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for May, 1874, as compared with that for the corresponding month of 1873, shows an increase of 6471 houses, and of 5,388,414 gallons of water supplied daily.

Dr. Frankland, F.R.S., reports, as the result of a chemical examination of the waters supplied to the metropolis during the month of June, that, taking the amount of organic impurity in a given volume of the Kent Company's water as unity, the proportional amount of this impurity in an equal volume of water supplied by each of the other metropolitan companies was—New River, 1·3; Southwark, 2·8; Grand Junction, 3·1; Chelsea and West Middlesex, 3·2; East London, 3·5; and Lambeth, 3·6. The waters drawn from the mains of the Chelsea, Southwark, Grand Junction, and East London Companies were slightly turbid, and each contained moving and living organisms. The Kent Company's water, derived from deep chalk wells, was, as usual, clear and transparent when drawn from the mains.

METROPOLIS GAS SUPPLY.

Report on the gas supplied by the Imperial Company to the vestry of St. Pancras, during the month of June, 1874:—Maximum light estimated by sperm candles, according to the Act—15·1:—Minimum light, sperm candles—13·1. Average light, sperm candles—14·3. Traces of ammonia, indicated by turmeric test-paper—traces on all occasions of examination. Traces of sulphuretted hydrogen, indicated by lead test-paper—none. Sulphur 20·73 grains per 100 cubic feet. The gas was of nearly the usual illuminating power.

THOS. STEVENSON, Gas Examiner.

KENSINGTON.—At the vestry meeting on the 1st., Dr. Dudfield, the medical officer, called attention to the gas question, and said that that was the day fixed by The Gaslight and Coke Company for commencing the supply of common coal gas in lieu of cannel. He advised the appointment of a special committee to investigate all matters connected with the supply of gas, and that the average meter system should be adopted.

ROCHDALE (CORPORATION) GAS SUPPLY.

Report of the Gas Committee to the Council of the Borough of Rochdale.

The Gas Committee present the following report on their department for the year ending on the 31st of March, 1874:—

	Cubic Feet.
Gas made this year	223,086,000
Ditto last year	221,174,000
Increase	1,912,000

Value of gas sold, after deducting discount	£36,460	10	4
Ditto last year	32,717	3	5
Increase	£3,743	6	11
The profits for the year amount to	£2,353	2	10
Ditto last year (after deducting £4000 for alteration or depreciation of works)	7,223	9	6
Being a decrease of	£4,870	6	8

The present number of consumers is	16,962
Ditto ditto last year was	16,519
Increase	443
New lamp services in addition to above	333
Making total new services laid this year	776

As the past three years have been of an exceptional character, your committee deem it desirable that they should in this report, as briefly as possible, review the same, that you may be reminded of the causes which led them to ask for an extension of the plant, and to enable them to lay before you a statement of the results realized.

In reports presented during the above period it was stated as an actual necessity that the works should be enlarged, and you were—especially in last year's report—informed that new apparatus was being erected. It was promised that the works should be equal to a supply of 1,750,000 feet per day, and as there were numerous complaints about the impurity of the gas, it was also promised that the new apparatus should accomplish all that could be desired in that respect. By last year's report you were led to expect some reduction in the quantity of coke used on the works, to be attained by the adoption of a setting of retorts whereby seven could be heated by one fire. Before proceeding to state what has actually been accomplished, it is desirable to state another reason which made it incumbent on your committee that considerable renewals should be made in the plant and buildings—viz., the fact that a great proportion of the old buildings and plant were in such a dilapidated state as to make it dangerous to work; in fact, scarcely a week passed during several winters up to 1872 without some explosion, and in several instances the workmen were seriously injured.

To remedy these defects, and to accomplish all desired on the present site, it was found necessary to enlarge the No. 3 retort-house, to increase the engine, boiler, and exhausting power, to erect new scrubbers, to remodel and extend the purifying department, and to nearly double the storeage capacity.

It is now the pleasure of your committee to state that all this work has been accomplished in a satisfactory manner. The new settings of retorts are found to answer all expectations; the advantages that were promised by them over the old settings were economy of space and saving in fuel. The first is a fact that is indisputable, and the latter is agreeably shown in the returns for coke. For instance, in 1872, 20,450 tons 7 cwt. 2 qrs. of coal and cannel were used, and 5303 tons 1 cwt. 3 qrs. of coke sold. This year, 22,707 tons 2 cwt. 2 qrs. of coal and cannel have been used. It follows that the sales of coke should have been 5888 tons 5 cwt. 2 qrs., instead of which the quantity sold was 7348 tons 11 cwt., being 1460 tons extra, representing in money a sum equal to one-third of the amount paid in stokers wages. In other respects, the retorts have given satisfactory results, the yield of gas per ton being considerably over the average quantity, although part of the material used has been of an inferior quality.

The engines, boilers, and exhausters are of the most substantial build and approved design, working fully up to expectations; the whole so efficient in working, and capable of passing more gas than hitherto made in Rochdale, that further extensions in this department will be unnecessary on the present site.

The new and powerful scrubbers have proved effective, and that it is possible to extract from the gas every particle of ammonia by the adoption of mechanical appliances worked by steam power.

The purification of the gas during the past winter has been accomplished in a manner far superior to anything done in any year since the works were erected, and notwithstanding this increased purity, the cost of labour and materials in this department is actually less than in the previous year.

For years previous to the winter of 1873-4 it was not possible to give the town an even pressure, but the increased storeage for gas has enabled the committee to meet the demands of the consumers every day during the past season.

The storeage for tar and ammoniacal liquor, though not yet completed, has been considerably increased.

A substantial stack of buildings has been erected, and are now in use for workshops, store-rooms, pump-room, engine, boiler, and exhauster houses.

The station-meters require a further outlay upon them or replacement by new. The gasholder-tank is now undergoing the necessary repairs, which are expected to be completed without much difficulty. During the year the main gas-pipes in 21 different places have been enlarged, renewed, or new ones laid, and the whole, now measuring over 65 miles, kept in thoroughly good repair.

The question has been raised as to the possibility of reducing the quantity of gas lost by leakage, which is on an average about 14 per cent. of all the gas made, and the attention of your committee has been directed to the various channels by which it is supposed the bulk of the gas is lost. Unquestionably a large proportion is lost by actual leakage or condensation as the gas passes through the 65 miles of main-pipes, and about 16,000 service-pipes. Another portion will be lost through defective or inaccurate registration by consumers meters. The attention paid to these departments leaves but little more that can be done. But there is another cause which it is possible to deal with—viz., the excessive consumption of gas by the street-lamps. Only 3¾ cubic feet of gas per hour is charged for each burner now in use; but they are capable of consuming up to 6 feet per hour without giving more light than others of a more suitable make, when only consuming two-thirds that quantity.

Your committee consider that the council ought to give assistance in any effort made to reduce the quantity of gas lost, and, as one means to that desired end, advise and recommend that the laying of service-pipes, and the entire fitting up of the street-lamps, be left solely in their hands, but that the expense, as hitherto, and the cost of governors, burners, and taps, be charged to the Building and Lighting Committee.

The amount of money to be borrowed from the Finance Committee on capital account during the year ended March 31, 1875, will not exceed £5000.

It is evident, from the experience of the past year, and the feeling expressed by the council from time to time, that the quality of the gas must be maintained at an average of about 18 candles illuminating power. Your committee, while anxious to meet the wishes of the consumer, feel it their duty to report, that it is impossible to make gas, anything approaching this quality, to sell at present prices, without incurring an actual loss upon the coming year's transactions; but in order that gas of this quality may be supplied, and that the selling price may produce an income sufficient to meet the estimated expenditure and leave a small surplus, you are recommended to confirm the resolutions submitted to you this day, which are as follows:—

1. That this committee recommend the council to raise the price of gas within the borough from 4s. 3d. to 5s. per 1000 feet, subject to the same scale of discounts as at present allowed, and that such rise in price date from the close of the quarter ending March last.*

2. That this committee recommend the council to raise the price of gas for the street-lamps to 4s. 6d. per 1000 net, and that such rise take place from the close of the quarter ending March last.

3. That this committee recommend the council to order that the price of gas outside the borough be raised to 5s. per 1000 feet net from the close of the quarter ending March last, and also that the sum of 3d. per quarter be charged for inspection of every meter outside the borough.

The prices named in the foregoing resolutions will make the average net selling prices to all consumers about 4s. 6d. per 1000 feet, to those within the borough a trifle less.

The income and expenditure for the year ending March 31, 1875, is estimated as follows:—

Income.

191 million cubic feet of gas at the advanced price	£43,068	19	8
Meter inspecting	68	16	0
Tar and ammoniacal liquor	2,683	13	4
Coke	3,593	15	0
Sundry profits and rents	103	0	0
	£49,518	4	0

Expenditure.

23,000 tons of coal and cannel, at an average cost of about 24s. 7d.	£28,258	8	0
Working expenses, including office expenses, wages, and all materials, except coal, cannel, and coke.	12,650	0	0
Interest	6,000	0	0
1-75th part of debt	1,800	0	0
Surplus as profits, or to meet any contingency.	809	16	0
	£49,518	4	0

Your committee are now considering the necessity and advisability of proceeding with the erection of new gas-works at Heybrook, on the site scheduled in the Rochdale Improvement Act, 1872.

April 28, 1874. WILLIAM SIMPSON, Chairman.

* [All consumers get discount if they pay within two months after expiration of quarter. The smallest get 4d. per 1000 feet. The discounts range from 4d. to 9d. per 1000 feet.—ED. J. G. L.]

THE LOCAL GOVERNMENT BOARD AND THE WATER SUPPLY.

The following circular to the various provincial sanitary authorities has been issued by the Local Government Board:—

"*Local Government Board, Whitehall, S.W., June* 29, 1874.

"Sir,—I am directed by the Local Government Board to state that, in consequence of the long continuance of dry weather, their attention has been drawn to the fact that in several parts of the country the ordinary water supply has become considerably diminished, and there is reason to be apprehensive that, as the summer advances, the evils arising from this cause will be much more seriously and extensively felt. Among such evils must be included the very serious danger to health which will arise if, for want of a better supply, recourse is had to polluted water. Under these circumstances, the board think it right to point out to the sanitary authority the importance of taking steps to inform themselves fully of the nature and extent of the existing water supply in the several parts of their district, and the sources which may properly be relied upon for the purpose of supplying any present or prospective deficiency. The board need scarcely remind the sanitary authority that one of the chief duties which the Legislature has imposed upon them is that of providing their district with a sufficient supply of water, and the board cannot too strongly impress upon them the expediency at the present time of adopting every available precaution for the storeage of wholesome water in those localities which are likely to suffer from drought. With this view it is desirable that the sanitary authority should make a careful examination of the existing sources of supply, so that they may, as far as practicable, be economized, and that steps may be taken, where necessary, to obtain an additional supply. If any part of the district is within the limits of a water company, their attention should, with the like object, be directed to the points lastly referred to. The sanitary authority are aware that if there is no such company, they themselves may not only construct and maintain water-works, but also dig wells, and do any other acts necessary for providing a water supply for their district. It is, therefore, competent for them, in case of need, to provide, by means of water-carts or other like expedients, a temporary supply for domestic use, and for flushing sewers and drains; and the cost attendant upon the adoption of this suggestion, which would be comparatively small, might be wholly or in part reimbursed by a moderate charge for the accommodation. I am directed to add that the greatest care must of course be taken with regard to the purity of the water which the sanitary authority distribute, that no supply should be used which is not perfectly safe from pollution by excremental matters or other filth, and that other impurities, if the water contains such, should be removed from it by filtration or otherwise before it is delivered for domestic use.—I am, sir, your obedient servant,

"JOHN LAMBERT, Secretary."

IRON AND COAL TRADES OF SHEFFIELD, NORTH DERBYSHIRE AND SOUTH YORKSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The iron trade remains in an uneventful, dull condition. There are few new orders for merchants iron, and no very large transactions in any description of pig iron. Quotations for Cleveland foundry pig are at present almost wholly nominal, No. 3 being 62s. 6d. to 65s. Most of the foundries are still enjoying a fair amount of activity in general descriptions of foundry work, heavy colliery castings, and gas and water pipes of large dimensions. In the last respect, it is understood that some good orders have recently been given out by various local and distant customers, and that their execution will of necessity spread over a long period.

In the coal trade business is quiet as a whole, albeit several firms are doing a fairly good trade in steam coal for shipment from Grimsby and the Humber ports. A moderately good tonnage is also being sent into Lancashire. Prices remain steady, being, in all probability, upheld by the fear of the great strike which appears likely to take place on Wednesday. Both masters and men held special meetings last week to further consider the question, and both arrived at the determination to adhere to the previously arrived at resolutions. The men will only agree to half the reduction required by the owners. The notices mostly expire on Wednesday, so that about 20,000 men will probably be out of work.

Mr. Thomas Hawksley, C.E., propounds a scheme for disposing of the sewage of Barnsley, which would cost about £50,000 to carry out.

At the annual meeting of the Conisborough Gas Company, the accounts and prospects of the concern were stated to be satisfactory, and it was thought fit not to proceed with the proposed sale of the works.

In consequence of the short supply of water at Rotherham—two hours daily—the Town Council have passed a resolution instructing the town-clerk to ascertain upon what terms the Sheffield Water Company would supply Rotherham in times of scarcity.

THE NORTHERN COAL TRADE.

(FROM OUR OWN CORRESPONDENT.)

The general condition of the northern coal trade is somewhat firmer. The coasting business has considerably improved, and though there have been very good arrivals, there are more orders to hand, which would be placed if there were vessels in port to make engagements. A fair quantity of gas coals is being shipped to the eastern counties ports by small sailing vessels; but there is no excessive demand in other directions for this quality of coal. The quotations on Newcastle Quayside are—Best gas, 13s. 6d.; seconds, 10s. 6d. to 11s. 6d., less 2½ per cent. discount. The iron trade, though it exhibits no briskness, is recovering somewhat from the recent depression occasioned by the strike of the ironstone miners, and there is a slightly improved demand for manufacturing coals, the price of which, however, is without change. Manufacturing coals for mixing are quoted at from 20s. to 30s. per chaldron, and small steam coals at 15s. per chaldron. There was a much better demand for coasting vessels last week, as already stated, and freights advanced slightly. The following rates were paid for the coast, mainly to load gas coals:—Yarmouth, 5s.; Lowestoft, 4s. 9d.; Lynn, 5s. 3d.; Wisbeach, 6s. 6d.; London, 6s. to 6s. 6d. per ton; Plymouth, £7 10s.; Penzance, £7 17s. 6d. per keel; Dartmouth, 7s. per ton. To the Irish ports: Waterford, £8 15s. to £9; Cork, £10 per keel. The pits in this district are working very steadily. Steam coals are the most in demand; but, except a little more firmness, it can hardly be said that the coal trade shows very much improvement, neither are quoted rates strictly adhered to.

A favourable reaction is still apparent in the chemical business of the Tyne. Some sorts of chemicals are a little scarce. During the week the chemical market has been steady, and much of the business done has been of a *bonâ fide* character, though in the early part of the week a little speculative trade was done. The general trade of the north of England has a more hopeful appearance than was apparent a few weeks ago. The price of several classes of goods having been brought within reasonable compass, buyers show more disposition to transact business, and a steadier trade is anticipated. The demand for material used for building purposes is better for home use than the Continent.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.—The second annual general meeting of this association was held at Dumfries on the 26th ult. A report of the proceedings has reached us, and we hope to find space for it in our next number.

PETERSBURG AND VIBORG COMPANY, LIMITED.—At a special meeting of the shareholders of this company, held on Thursday last, at which nine-tenths of the shares were represented, a resolution was passed unanimously condemning the action of the liquidators of the Patent Gas Company, in presenting a petition for winding up this company.

REDUCTION IN THE PRICE OF GAS AT AYR.—At the annual meeting of the Ayr Gas Company, held on the 1st inst., a dividend at the rate of 6 per cent. was declared for the past year, and the recommendation of the directors to reduce the price of gas 10d. per 1000 cubic feet (7s. 6d. to 6s. 8d.) was agreed to.

BIRMINGHAM WATER SUPPLY.—Dr. Hill, the medical officer of health for Birmingham, reports that the water supplied to that town in June was "very turbid," and that its proportion of organic nitrogen continued unduly high.

GLASGOW WATER SUPPLY.—The water from Loch Katrine supplied to Glasgow during the month of June, according to the report of Professor Bischof of the Andersonian University, was, as usual, very soft, and free from evidence of previous sewage or animal contamination, although it was "slightly yellowish and opaque, through suspended matter."

GAS LIGHTING BY ELECTRICITY.—A new pneumatic gas lighting apparatus, now being introduced by Mr. Asahel Wheeler, of Boston, Mass., was recently tested at Providence, R. I., with satisfactory results. A current of compressed air is transmitted from a central engine to diaphragms at the burners, the moving of which turns on the gas, which is then lit by an electric spark. Forty lights were kindled and extinguished simultaneously with great rapidity. It is stated that by this device all the street, lamps in a city may be lit by the movement of a single lever, at any certain point.—*Scientific American.*

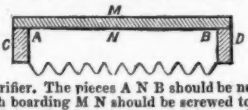
SULPHUR IN COAL GAS.—Mr. T. W. Keates, the chief gas examiner to the Metropolitan Board, has addressed a letter to a contemporary on this subject, in which he says:—"Sulphur burned in the air is converted into the gas called sulphurous acid. This is the suffocating gas which is produced when a sulphur match is lighted; and the sulphur contained in the coal gas is converted into it during the burning of the gas, and it passes into the atmosphere with the other products of combustion. Twenty grains of sulphur produce when burned 40 grains of sulphurous acid, which in bulk equal rather more than 58 cubic inches. So that 100 cubic feet of gas, containing 20 grains of sulphur, produce in burning 58 cubic inches of sulphurous acid gas. An ordinary fishtail gas-burner consumes about 4 feet of gas per hour; consequently, in a long evening, say from six to twelve, it would consume 24 feet of gas. Two such burners afford light sufficient for a good-sized room, and would consume 48 cubic feet of gas in six hours, producing in the atmosphere of such a room nearly 28 cubic inches of sulphurous acid gas. Supposing the room to be only 12 feet square, and 10 feet in height, its contents would be 1440 cubic feet of air; the 28 cubic inches of sulphurous acid gas are less than 160th of a cubic foot, or 1-86,000th of the cubical contents of the room. Moreover, it must be remembered that this quantity is only thrown into the atmosphere *gradatim* during six hours, and that during that time some change in the air of the room must be taking place. It will, then, be seen that the talk which is made about the 'sulphur in gas' is, after all, raised upon what is practically a thing of very little, if any, importance, from a sanitary or economical point of view. It will be further seen how utterly trifling this is when it is considered that common house coal contains from 2 to 3 per cent. of sulphur, which is converted into sulphurous acid during its combustion. Every 100 lbs. of such coal yields, consequently, say 2·5 lbs. of sulphur, which produces, in burning, 5 lbs. of sulphurous acid, which is equal to no less than 50,940 cubic inches of this gas. It is a moot question whether small quantities of sulphurous acid may not be wholesome rather than the reverse in an atmosphere charged, as that of the metropolis must always be, with organic exhalations; but, however that may be, the quantity produced in the combustion of common gas is far too small to permit of its producing any sanitary effect, noxious or otherwise. There is a question of great, nay, of the greatest, importance to gas consumers, but it is one which relates to themselves, and not to the gas manufacturer—that is, the proper ventilation of the rooms in which the gas is burned. One of the vices of gas consumption is the employment of an unreasonable amount of light. In a sitting-room, for example, which was formerly thought to be well enough lighted by a pair of wax or composite candles, two gas burners are commonly employed. Two fishtail burners give light equal to that from 18 to 20 wax candles. How can we be surprised, then, at hearing the common complaint that 'gas heats the room so much?' In a broad sense, the amount of heat produced by burning ordinary gas is proportionate to the amount of light, and the vitiation of the atmosphere is similarly proportionate to both, and it is in relation to this evil—one in nowise related to the gas manufacture, nor really to the character of the gas itself—that some alteration is required: the more complete ventilation of our rooms and warehouses is the solution of the problem. Parliament has provided a standard of lighting power, and the means of checking the quality of the gas as to its purity; and there are plenty of watchful eyes in the heads of the different officers of health ready to detect and denounce any attempt at an evasion of the law. In the City of London and the larger portion of the metropolis at least every one can judge for himself, for the reports are periodically published; but the remedy of the most serious evil—viz., the inhalation of air highly charged with the common results of the combustion of a carbonized material—lies wholly beyond the reach of gas companies and officers of health, resting, as it does, entirely upon the internal arrangements by which gas is made available to use in shops, warehouses, and private dwellings."

Notes and Queries.

Exhausters (reply to Inquirer).—Permit me to inform "Inquirer" that an exhauster 2·8 × 1·8 will pass 25,000 cubic feet of gas per hour, running at a speed of 80 revolutions per minute; engine indicating 40. A six-horse power vertical or horizontal engine will work the above efficiently, and do the necessary pumping required on a small works. J. R.

Sulphurous Acid Gas as a Curative.—Mr. Magnus Ohren writes: "Mr. George Anderson, Mr. Dewar, and other of your correspondents on this subject, will be delighted to hear that the dumb can be made to speak after passing a certain time in a purifying-house. According to the *Springfield* (*Mass.*) *Republican*, Mr. B. A. Leonard, a dumb man, residing at Southbridge (Mass.), recently recovered his voice, which he had lost about a year previously, after an attack of cerebro-spinal meningitis. He was awakened one morning about four o'clock by a sense of oppression and faintness, and became conscious that coal gas was escaping from a stove. After many attempts he got outside, where he fainted. When he recovered, the thought came to him that his wife and child were in the house, and though he had not spoken for months, he called loudly for help. He roused a neighbour, and having told his troubles, again fainted, and was insensible for two hours, and, on recovery the second time, was unable to speak. The doctor, on hearing his case, ordered him to visit the gas-works, and breathe air in the purifying-house. After an hour and a half he could speak in a whisper, and has since steadily regained the perfect use of his voice. Perhaps gas managers will oblige their dumb friends by making this cure known to them."

Tarry Matter in Gas (reply to R. R).—If R. R. has an old purifier beside him, let him lengthen the inlet until it stands within two inches of the top of the lute, and close to the side of the purifier. Get a joiner to make some pieces of wood thus,



the distance C D being equal to the width of purifier. The pieces A N B should be notched into C A and B D, 9 inches apart. The ⅝-inch boarding M N should be screwed to the side-piece, and serrated boards, and extend from side of purifier above inlet to within two inches of the outlet side. Fill with liquor half an inch higher than top of serrations, put on the purifier cover, and all his tar troubles in purifier proper will disappear. When his liquor is 13 oz., draw it off into paraffin casks, and keep it for sale; 40,000 feet of gas will strengthen 250 gallons, ammoniacal liquor 3 oz., with about six dips into the liquor. R. R. may get nearly 1s. perton for the liquor by adopting this plan, which the writer has tried. T. H. M.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

GWYNNE & BEALE'S PATENT IMPROVED GAS-EXHAUSTERS,

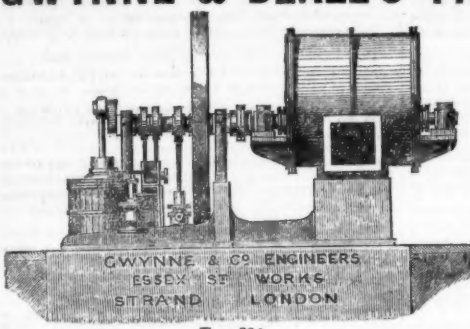


FIG. 224.

The BEST EXHAUSTERS IN THE WORLD.

Made under the personal superintendence of

Mr. BEALE,

The oldest Maker, Inventor and Patentee of

GAS-EXHAUSTING MACHINERY.

(It is NOT CORRECT to state that Mr. BEALE has RETIRED.)

Prices and every information on application.

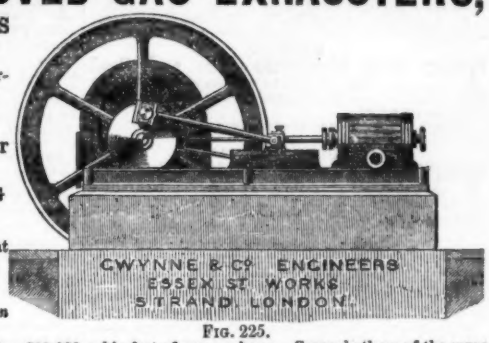


FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the most perfect system of action yet discovered. Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND Co. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,

CAN BE HAD ON APPLICATION TO

GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

G. & Co. are now manufacturing for a London Gas Company three of their 210,000 cubic feet Patent Gas Exhausters, and many of all sizes.

WANTED, by the Hong Kong and China Gas Company, a RETORT-SETTER; one competent to act as yard foreman preferred.

Apply, by letter, to the Secretary, C. E. WALDUCK, 148, Gresham House, LONDON, E.C.

WANTED, by the Advertiser, aged 30, a situation as FITTER, Meter-Fixer, Repairer, Index-Taker, &c.

Address A. K., care of Mr. Beck, High Street, Wandsworth, SURREY.

WANTED, a man able to read and write, as YARDMAN, at a small Gas-Work in the country, to deliver coke, get in coal, and make himself generally useful. Wages to commence at 21s. per week.

Apply to J. T. Z., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, in the drawing office of a Gasholder, Boiler, and General Gas Engineering Works, an intelligent youngman as IMPROVER or Pupil. Moderate premium required.

Address B. A., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Foreign Water-Works Company an ENGINEER to undertake the duties of General Manager and Resident Engineer. A linguist preferred.

Apply, stating salary, to AQUARIUS, care of Mr. Vickers, Cowper's Court, CORNHILL.

WANTED, for a Gas-Work in the West of England, where the make does not exceed 10 millions per annum, an experienced WORKING MANAGER, who thoroughly understands the manufacture and distribution of gas, the setting of retorts, and is conversant with every detail in connexion with the efficient management of a Gas-Work, but will not be required to keep the accounts.

Apply, by letter, with copies of testimonials, and particulars as to capabilites and salary required, addressed to X. Y. Z., care of Messrs. G. Glover and Co., Ranelagh Road, LONDON, S.W.

VINCENT'S

PATENT IMPROVEMENTS

IN

Apparatus for Manufacturing Gas.

Particulars to be obtained by application to—

MR. LAYARD JONES,

ENGINEER,

25, OLD BROAD STREET, LONDON, E.C.

ADVANTAGES OF GAS FOR COOKING AND HEATING,

BY

MAGNUS OHREN, A.I.C.E., F.C.S.

For Companies to issue to their gas consumers.

Specimen Copy by post 4d., direct from MAGNUS OHREN, Gas-Works Lower Sydenham, London, S.E.

WANTED, a respectable man to take CHARGE of a small Gas-Work in the country, who has been accustomed to the work. House, gas, and fuel on the works.

State lowest wages, &c., required to Messrs. THOMAS AND Co., 40, Gracechurch Street, CITY.

TO GAS-WORK MANAGERS.

WANTED immediately, a steady, work-ing MANAGER for the Gas-Works of Skibbereen, in Ireland. Wages 30s. per week, with house, coal, and light free.

Send references as to character and experience to GEO. BOWER, St. Neots, HUNTS.

WANTED, a Gentleman of energetic habits as AGENT for the sale of Gas Coals and Nuts of various qualities. None need apply but those who have a good connexion at the present time with Gas Companies in all parts of England.

Address, stating salary required, MERCHANT, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an engagement as Manager or MANAGER and SECRETARY of a medium sized Gas-Work. Thoroughly understands the manufacture and distribution of gas, having had many years experience, and can give most excellent testimonials as to character and ability.

Address MANAGER, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Gentleman, aged 27, a situation as MANAGER, on the Continent or abroad. Advertiser has been four years in present situation, where the make is above 90,000,000 feet per annum. Understands the manufacture and distribution of gas in all its branches. Speaks French and Italian. Leaving present situation on account of salary being insufficient.

Address SCIENCE, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SLIDE-VALVES.

FOR SALE—14 12-in. and 5 10-in. Slide-VALVES with outside racks. They have been thoroughly re-fitted, and are equal to new. A low price will be accepted to effect a clearance.

Apply to JAMES WATSON, Engineer and Manager, Crystal Palace District Gas Company, LOWER SYDENHAM, S.E.

ON SALE—One 50-ft. by 16-ft. Gasholder, with chains and balance-weights, with 7-in. inlet and outlet pipes, and hydraulic valves all complete. Can be seen working at the Radcliffe and Pilkington Gas-Works, near Manchester.

Any further information with respect thereto may be obtained on application to D. BRANDWOOD, the Company's Manager and Secretary.

PIPES.—A large stock of 3-in., 4-in., 6-in., and 8-in. Cast-Iron SOCKET and SPIGOT PIPES (usual weights) ready for immediate delivery, either f.o.b. or ex ship or steamer in the Thames.

Address the MANAGER, Milton Iron-Works, WEST HARTLEPOOL.

THE THAMES BANK IRON COMPANY,

(Successors to LYNCH WHITE,)

SUPPLY FROM STOCK

CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.

All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.

ADDRESS—

OLD BARGE WHARF, UPPER GROUND STREET, LONDON, S.E.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Elland-cum-Greet-land Gas Company are prepared to receive TENDERS for the TAR and AMMONIACAL LIQUOR produced on their works for One or Three years, from the 21st day of November next.

Tenders to be sent to the Gas Office, Elland, on or before Friday, the 10th day of July next.

ROBERT WEST, Secretary.

Gas Office, Elland, June 26, 1874.

TO TAR DISTILLERS.

THE Buxton Local Board invite Tenders for the TAR and LIQUOR that may be produced on their works at Buxton, in One, Two, or Three years, commencing on the 1st of January, 1875.

Tenders, endorsed "Tenders for Tar, &c.," to be sent in on or before the 14th inst., addressed to the Chairman of the Gas Committee, Court House, Buxton.

The Board is not bound to accept the highest or any tender.

Further particulars may be had of Mr. G. SMEDLEY, Manager, Gas-Works, Buxton.

JOSIAH TAYLOR, Clerk to the said Board.

Buxton, July 1, 1874.

NORTH BRITISH ASSOCIATION of GAS MANAGERS.

The THIRTEENTH ANNUAL GENERAL MEETING of this Association will be held in the

HALL OF THE ANDERSONIAN UNIVERSITY,

GEORGE STREET, GLASGOW,

On TUESDAY, the 14th of July current, at Eleven o'clock a.m.

WILLIAM FOULIS, ESQ., PRESIDENT,

Will occupy the Chair.

PROCEEDINGS.

I.—BUSINESS MEETING.

1. Reading of Minutes.
2. Auditor's Report.
3. Election of Office-bearers for the ensuing year.
4. Admission of New Members, &c.

PRESIDENT'S INAUGURAL ADDRESS.

II.—PAPERS AND COMMUNICATIONS.

"A Self-Acting Seal for Ascension-Pipes, and Improvements in Hydraulic Mains." By Mr. J. ALEXANDER, Corstorphine.

"The Economic Results from the Use of Revivified Lime in the Purification of Coal Gas." By Mr. JOSEPH GIBB, Armagh.

"A New Form of Slide-Valve Pump, specially adapted for Heavy or Thick Tar," &c. By Mr. D. M. NELSON, Glasgow.

"An Improved Hydraulic Dip-Pipe." By Mr. GEORGE BOYD, Alloa.

"Stoppages in Ascension and other Pipes: Their Causes, Remedies, and Relative Advantages." By Mr. A. MALAM, Dumfries.

Drawings and Models, illustrative of the foregoing, will be exhibited.

After the reading of Papers, the Meeting will adjourn until Five o'clock, at which hour a Lecture will be delivered "On the Influence of Pressure on the Photogenic Value of Coal Gas, and on a New System of Photometry." By Dr. WILLIAM WALLACE, Gas Examiner for the City of Glasgow.

On Wednesday, July 15th, an opportunity will be afforded the Members to visit and inspect the extensive new Gas-Works recently erected at Maryhill, for the supply of the city of Glasgow. Details as to the arrangements will be intimated at the Meeting,

WM. M'KENZIE, Hon. Sec.

Gas-Works, Dunfermline, July 1, 1874.

TO GAS COMPANIES.

A Quantity of Bright Derbyshire Gas COAL, of excellent quality, having been carefully tested in practical working, FOR SALE.
For quotations, address Mr. W. A. PLUMBE, MANSFIELD.

CANNEL.

THE West Yorkshire Iron and Coal Company, Limited, will be glad to receive FORMS for TENDERS from Gas Companies and others requiring a supply of CANNEL.
Address, 72, Wellington Street, LEEDS.

TENDERS FOR COAL.

THE Directors of the Guildford Gaslight and Coke Company are prepared to receive TENDERS for the supply of 2200 tons of the best GAS COALS, to be delivered at their works as follows:—

200 tons in August, 1874.
200 „ „ September, 1874.
300 „ „ October, 1874.
300 „ „ November, 1874.
400 „ „ December, 1874.
400 „ „ January, 1875.
400 „ „ February, 1875.

Tenders to be sent to the Office, at the Gas-Works, on or before the 29th of July, addressed to the Chairman, endorsed "Tender for Coals," to state the name and description of Coal.
The Directors do not bind themselves to accept the lowest or any tender. JOSH. SHAW.
Guildford Gas Company, June 30, 1874.

TO COLLIERY PROPRIETORS, AGENTS, &c.

THE Buxton Local Board invite Tenders for their supply of COAL and CANNEL during the year ending July 31, 1875, to be delivered at their Gas-Works siding, on the Midland Railway, Buxton, or in the yard of the Gas-Works, at such times and in such quantities as the Manager may direct.
Tenders, endorsed "Tender for Coal or Cannel," addressed to the Chairman of the Gas Committee, Court House, Buxton, to be sent in on or before the 14th inst.
The Board is not bound to accept the lowest or any tender.
Further particulars may be had of Mr. G. SMEDLEY, Manager, Gas-Works, Buxton.
JOSIAH TAYLOR, Clerk to the said Board.
July 1, 1874.

TENDERS FOR GAS COAL.

THE Directors of the Ratcliff Gaslight and Coke Company are prepared to receive TENDERS for the supply of about 16,500 tons of best GAS COAL, of which a specification may be obtained on application to the Engineer, at the works, New Crane, Wapping, E.
Tenders to be sent in, endorsed "Tender for Coal," on or before the 13th day of July, 1874, to the Secretary, at the Company's Offices, 345, Cable Street, London, E.
The Directors do not bind themselves to accept the lowest or any tender, but the person or persons whose tender may be accepted will be required to execute an agreement, prepared by the Company's solicitors, for the due performance thereof.
July, 1874.

ALLIANCE AND DUBLIN CONSUMERS GAS COMPANY.

TO IRON CONTRACTORS.

THE Directors of the Alliance and Dublin Consumers Gas Company are prepared to receive TENDERS for the Construction of a Wrought-Iron ROOF, about 70 ft. span by 323 ft. long, over their No. 1 Retort-House, No. 2 Station, Great Brunswick Street, Dublin.
The drawings, specification, and form of tender can be seen on application either at the Gas Company's Office, Grafton Street, Dublin, or at the Office of Messrs. Jabez Church and Son, Civil Engineers, 173, Great George Street, Westminster.
Tenders are to be sealed and endorsed "Tenders for Roof," and delivered to the Secretary, at the Office of the Company, 114, Grafton Street, Dublin, on or before the 14th of July, 1874.
The Directors will not bind themselves to accept the lowest or any tender.—By order,
W. F. COTTON, Secretary and Manager.

BRITON FERRY GAS-WORKS.

TO IRON FOUNDERS AND GAS APPARATUS MANUFACTURERS.

THE Gas Committee of the Briton Ferry Local Board of Health solicit TENDERS for the supply, delivery, and fixing, at their Gas-Works, Briton Ferry, of the undermentioned GAS APPARATUS:—
Six 15-in. diameter round retort mouthpieces complete, with 12 wrought-iron lids, cross-bars, screws, and lugs.
Six 6-in. equal ascension-pipes.
Six 6-in. arch-pipes.
Six 6-in. dip-pipes.
Two 6-ft. 2-in. lengths of 20-in. by 17-in. box-shape hydraulic main.
One vertical condenser, with 6-in. connexions.
One 3-ft. 6-in. diameter by 18 ft. high combined washer and scrubber, with 6-in. connexions.
One 6-in. "dry" centre-valve.
Four dry lime purifiers, 6 ft. by 6 ft. by 3 ft. 6 in., with wrought-iron plate covers, wood grids, lifting apparatus for covers, and 6-in. "dry" centre-valve, together with sundry 6-in. pipe connexions.
Copies of the specification, with conditions of contract and form of tender, may be obtained on application to Mr. John Lees Cocker, Gas-Works, Merthyr Tydfil.
Sealed tenders, endorsed, "Tender for Gas Apparatus," and addressed to the Chairman of the Gas Committee of the Local Board of Health, Briton Ferry, to be forwarded under cover to the undersigned, on or before the 18th day of July next.
Neither the lowest nor any tender necessarily accepted.
By order,
HENRY WILLIAMS, Clerk to the said Board.
Briton Ferry, near Neath, Glamorganshire,
June 27, 1874.

BRONNER'S PATENT GAS-BURNERS give 99 per cent. of light, as compared with 27 per cent. given by ordinary burners, with equal consumption of gas.—*Vide* "Gas Referees Report," published June, 1869.
HENRY GREENE AND SON, Sole Consignees of Brönner's Patent Improvements in Gas Lighting, 16 and 17, King William Street, LONDON, E.C.

FERNDALE GAS AND WATER COMPANY.

TO CONTRACTORS AND IRONFOUNDERS, &c.

THE Ferndale Gas and Water Company, Limited, Ferndale, near Pontypridd, Glamorganshire, solicit TENDERS for the various works to be done in the erection of GAS-WORKS.
The contract or contracts will comprise the excavation, masonry, &c., for a cast-iron Gasholder-Tank, the building of Boundary Walls, Coal Store and Retort-House, Lime-House, Purifier-House, Station-Meter House, Governor-House, Office, and other erections, together with all the Apparatus, 6-in. Connexions, and Street Mains requisite in the construction of such Gas-Works.
Full particulars may be obtained, and inspection of the plans and specifications, after the 30th inst., on application to the Company's Engineer, Mr. JOHN LEES COCKER, Gas-Works, Merthyr Tydfil.
Sealed tenders, to be forwarded to the undersigned, will be received up to the 18th of July proximo, endorsed "Tender for Excavation," "Buildings, &c," or "Apparatus," as the case may be.
Tenders may include the whole of the work to be done, but a separate sum must be stated for the excavation, the various buildings, and each portion of the apparatus and mains.
The Directors reserve the right to accept or reject any tender, whether the lowest or otherwise.
By order,
J. EDWARDS PRICE, Secretary.
The Court House, Pontypridd.

GAS LIGHTING & EXTINGUISHING by GALVANIC ACTION and GAS PRESSURE.
NOTICE IS HEREBY GIVEN that the original English Patent for "Igniting and Extinguishing Gas," dated the 8th of December, 1870, granted to W. Lloyd Wise, of London, as a communication to him from Professor W. Klinkerfues, of the Royal Observatory, Göttingen, Hanover, together with all further improvements made by him, was sold absolutely in 1871 to John Billington Booth, Esq., of Preston, England, Chairman of the Preston Gas Company.
NOTICE IS HEREBY FURTHER GIVEN that the said Professor Klinkerfues and Herr W. Lambrecht, Electrician, of Göttingen and Vienna, have, by a letter dated the 6th of June, 1874, requested the said John Billington Booth to make known through the English newspapers *that he is the sole owner of the original English Patent* for "Igniting and Extinguishing Gas," as aforesaid; and that they are prepared and willing to render to him, or to any one he may appoint, every assistance, with their improvements and practical knowledge and experience, to make the said Invention a complete success.
The third year's tax on the above Patent was duly paid, and any attempted infringement will be carefully watched.
Information respecting the use or sale of the above patented Invention may be had from YATES W. BOOTH, Patent Agent, 2, Chapel Street, Preston.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET,
DURHAM.
Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.
Agent in London, Mr. J. MANWARING, 101 Cannon Street E.C.

PATENT FUEL AND LIME FOR PURIFYING FROM FOUL LIME.
By a simple process the Foul Lime is converted into Fuel, by the combustion of which the lime is reproduced as a purifying agent.
Licences to work the invention will be granted to Gas Companies on very reasonable terms.
For further particulars apply to Mr. E. MADDOCKS, Manager of the Gas-Works, KETTERING.
The adoption of the above invention, without a licence from the Patentee, will be an infringement of the patent, and will subject the person or company guilty of such infringement to legal process.

Just published, price 10s. 6d.,

REGISTRATION OF DISTRIBUTORY PLANT.
The forms for this purpose are to illustrate the Paper on Distribution of Gas, read at the Edinburgh Meeting of the British Association of Gas Managers. By the use of the synopsis the whole of the out-door plant may at once be seen, with all matters pertaining to the same.
W. J. WARNER, Engineer.
South Shields.

TO GAS COMPANIES, ENGINEERS, MANAGERS, &c.

DESIGNS & PLANS of GAS-WORKS,
EXTENSIONS AND ALTERATIONS,
DRAWINGS AND TRACINGS OF GASHOLDERS,
TANKS, RETORTS, RETORT-HOUSE FITTINGS, ROOFS, GIRDERS, CONDENSERS, SCRUBBERS, ENGINES, BOILERS, EXHAUSTERS, PURIFIERS, GOVERNORS, VALVES, &c.,
Prepared with despatch, and at a moderate rate.
HILL AND CO.,
23, Southampton Buildings, Chancery Lane, W.C.

BAILEY'S Patented Inventions are now in extensive use wherever steam is known. Bailey's Patent Steam Gauges, Pyrometers, Water Gauge Cocks, Test Pumps, Fusible Plugs, Steam and Water Valves, Safety Valves, Junction Valves, Pumps, Tell-Tales, Recorders, Lightning Conductors, Electric Telegraphs, Turret Clocks, Steam Joint Cement, Lifting Jacks, Boiler Feeders, Lime Catcher and Separator, Injectors and Ejectors, and every description of first-class Brass Work for Engines and Boilers. Gas-Works Managers who have not our large book should send for it.

16th edition, 1000 engravings, 4to., post free 2s. in stamps, weight 10 oz., cost of production £1000,

BAILEY'S Illustrated Inventions, containing details and prices of goods in our five several departments:—(1) Brass Foundry, Steam Gauges, Indicators, Feeders, and Fittings; (2) Engineers Sundries, Small Tools, and Stores; (3) Machine Pump and Fire Engine; (4) Turret Clock, &c.; (5) Electric Telegraph, A B Instruments, Bells, and Apparatus.
J. BAILEY and Co., Albion Works, Salford, LANCASHIRE.

Mr. ALFRED LASS,
60, CORNHILL, LONDON, E.C.,
Is prepared to open the Books, and, if necessary, keep the Accounts of Gas and Water Companies.
To examine the Books and Accounts, and prepare Balance-Sheets for the information of Directors.
To assist Secretaries in preparing Balance-Sheets, according to the "Gas-Works Clauses Act, 1871;" or may be consulted with respect to Accounts generally.

MR. NORWOOD EARLE, late of the Dover Gas-Works, is prepared, after 17 years experience, to undertake the duties of SURVEYOR to Gas Companies and Corporations in all matters relating to the Distribution of Gas and Gas Testing. Contracts entered into for the Survey of Mains, Services, Public Lamps, &c., in order to reduce the per centage of unaccounted-for gas to the lowest possible amount.
Valuations for Assessment, Transfer, and other purposes.
Arrangements made with Companies desiring the occasional use of an Office in the City.
12, QUEEN VICTORIA STREET, LONDON, E.C.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.
Patents procured for Foreign Countries.
Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 43, Parliament Street, WESTMINSTER.

CATHELS'S Patent District Dry Gas- GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.
For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS & TERRACE'S Patent Four- WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.
For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

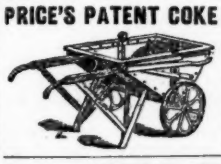
COTTERILL'S PATENT STEEL TUBE- DRILLS, for connecting services to water, gas, any steam mains and boilers, under pressure, without and escape of water, gas, or steam. The drills are made ¼ in. diameter and upwards. The price of ¼ in. is 1s. 3d. each; others in proportion.
Apply to CHARLES FORSTER COTTERILL, Finney House, Cannock, STAFFORD, Patentee.

OXIDE OF IRON.—
We are prepared to supply, on moderate terms,
HYDRATED PEROXIDE OF IRON (BOG OCHRE),
Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.
FRANCIS RITCHIE & SONS,
BELFAST.

HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,
SUPPLY GAS & WATER PIPES of EVERY SIZE.
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
LONDON OFFICE: 25, LAURENCE POUNTNEY LANE.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 20 & 22, WHARF ROAD CITY ROAD, LONDON, N.,
Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including Iron Retorts, Socket and Flange Pipes, Bends, Branches, and Syphons of all sizes, Lamp Columns, &c., &c.
N.B.—Orders for Cast-Iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention. CHARLES HORSLEY, Agent.

PRICE'S PATENT COKE & COAL BARROW.



effecting a great saving of time, labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

EMILY GIBBONS,
Dibdale Fire-Clay Works & Colliery,
Near STOURBRIDGE.
(ESTABLISHED 1834.)
MANUFACTURER OF EVERY DESCRIPTION OF
Burs, Lumps, Stays, Shields, Blast Furnace and other Bricks & GAS-RETORTS.
Red and Blue Clay Goods, Engineering and other Ironwork, and Fittings supplied.
N.B.—Above works having been recently enlarged, orders of any magnitude for HOME or EXPORT Trade will receive immediate attention.

ALFRED WILLIAMS,

PHŒNIX FIRE-BRICK WHARF,

64, BANKSIDE, SOUTHWARK, LONDON, S.E.

GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS-WORKS,
AND FOR THE
SUPPLY OF RETORTS, FIRE-BRICKS, CAST-IRON MAINS,
AND ALL MATERIALS FOR GAS MANUFACTURE AND DISTRIBUTION.

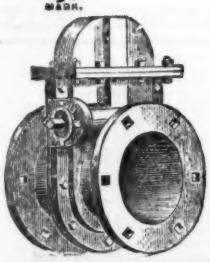
F. & C. OSLER,

45, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.
ESTABLISHED 1807.
MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.
TABLE GLASS OF ALL KINDS.
CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

SPENCE BROS. CHEMICAL COMPANY, LIMITED,

MANUFACTURERS OF
SULPHATE OF AMMONIA, VITRIOL, PATENT DRY COPPERAS, &c.
PURCHASERS OF
SPENT OXIDE AND AMMONIACAL LIQUOR;
AND CONTRACTORS FOR THE
PURIFICATION OF COAL GAS.
ALL COMMUNICATIONS TO
VICTORIA CHEMICAL WORKS, BRADFORD, MANCHESTER.

B. DONKIN & CO.'S IMPROVED GAS-VALVES



WITH WROUGHT-IRON PINIONS,
List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.
These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.
VALVES MADE WITH OUTSIDE RACKS TO ORDER.
ALSO, SCREW WATER-VALVES WITH GUN-METAL FACES.
ALSO SOLE MAKERS OF
J. BEALE'S NEW PATENT GAS EXHAUSTERS.

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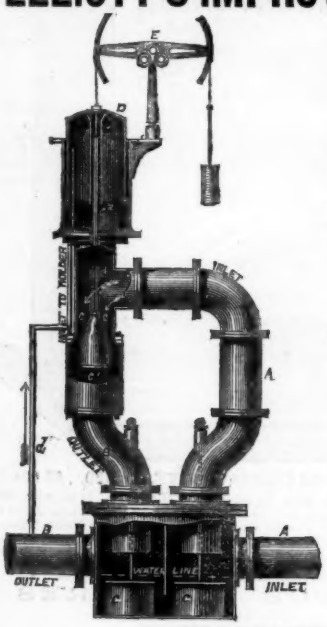
GENERAL ENGINEERS AND IRONFOUNDERS,
MAKERS OF STEAM-ENGINES,
BLUE ANCHOR ROAD, BERMONDSEY,
LONDON, S.E.

ELLIOTT'S IMPROVED STATION GOVERNOR.



The advantages of this Governor are—

1. The entre absence of oscillation.
2. No danger of explosion.
3. Perfect uniformity of pressure.
4. Economy of space; a 15-inch holder being sufficient for a 10-inch Governor.
5. The holder can be placed at any height in relation to the cone.
6. It admits of a simple, effective, and cheap bye-pass arrangement.

LIST OF PRICES.

For Governor only.		Governor, with Hydraulic Bye-Pass, complete.	
3 inch . .	£12 15 0	3 inch . .	£19 5 0
4 ,, . .	14 8 0	4 ,, . .	21 5 0
5 ,, . .	16 4 0	5 ,, . .	25 15 0
6 ,, . .	18 14 0	6 ,, . .	28 10 0
7 ,, . .	21 6 0	7 ,, . .	33 0 0
8 ,, . .	23 15 0	8 ,, . .	38 10 0
10 ,, . .	26 5 0	10 ,, . .	44 0 0
12 ,, . .	30 10 0	12 ,, . .	48 0 0

Prices for Larger Sizes on application.

ALL INQUIRIES TO BE ADDRESSED TO
J. ELLIOTT, STOURBRIDGE.

THOMAS ALLAN & SONS, of Springbank Iron-Works, Glasgow, manufacture small cast-iron GAS AND WATER PIPES, 1½ to 6 inches, at their branch works, Stockton-on-Tees, and have at present a large stock, which they are open to sell at moderate prices

RICHARD THOMAS & CO.,
40, GRACECHURCH STREET,
Manufacturers of
EWELL FIRE-BRICKS, CLAY, AND CEMENT.
Warranted the best quality.
WORKS AT EPSOM.

ADDISON POTTER,
WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of
CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

THOMAS LAMBERT & SONS
MANUFACTURE EVERY DESCRIPTION OF
GAS AND WATER FITTINGS;
ALSO,
WROUGHT-IRON TUBES & FITTINGS.
SHORT STREET, LAMBETH, LONDON.

INTERNATIONAL EXHIBITION, 1862.
CLASS X.
PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and
"HONOURABLE MENTION" for
good quality of Fire-Bricks.
WILLIAM STEPHENSON & SONS,
THROCKLEY,
NEWCASTLE-ON-TYNE.

HARRIS AND PEARSON,
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Proprietors of
BEST GLASS-HOUSE POT AND CRUCIBLE CLAY:
Manufacturers of
FIRE-BRICKS, GAS-RETORTS, & FIRE-CLAY GOODS
of every description.
Orders of any magnitude, for home and exportation, executed with all possible despatch.
N.B.—A quantity of Retorts in stock. Circulars, 15 in. and 16 in. Ovals, 20 in. by 14 in. D's, 15 in. by 15 in.; 16 in. by 12 in.; 18 in. by 14 in. 20 in. by 16 in.; 21 in. by 14 in.; and 24 in. by 14 in.

BOUCK & CO., LIMITED,
MANUFACTURING CHEMISTS,
TAR AND AMMONIA DISTILLERS, &c.,
MILES PLATTING, MANCHESTER.
WM. LITCHFIELD, SECRETARY.

CONTRACTORS for the PURCHASE of GAS TAR AND AMMONIACAL LIQUOR,
Also of their products.

HUTCHINSON BROTHERS,
ALBERT WORKS,
CHURCH STREET, BARNSLEY,
GAS ENGINEERS AND GENERAL COLLIERY FURNISHERS.
Plans, specifications, and estimates supplied, and contracts taken to furnish and erect Gas-Works complete, for supplying Manufactories, Collieries, Mansions, Malls, Railways, and other works.
Competent workmen sent out to town or country.
Agents for the supply of the best qualities of South Yorkshire House and Gas Coal. Prices and particulars on application.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE
FIRE CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICK.
Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
Successors to
E. BAKER AND CO. LATE BRIERLEY HILL, STAFFORDSHIRE.

CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers Steam Joints.

T. BUGDEN, Manufacturer,
79, GOSWELL ROAD, LONDON, E.C.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT J. KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & Co., GHENT, will receive immediate attention.

FIRE-CLAY RETORTS.

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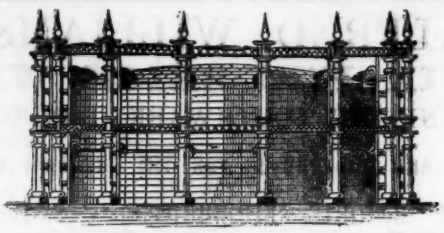

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Retort-Lids, Boilers, Cast and Wrought Iron Tanks, Iron Roofing, Bridges, Girders,

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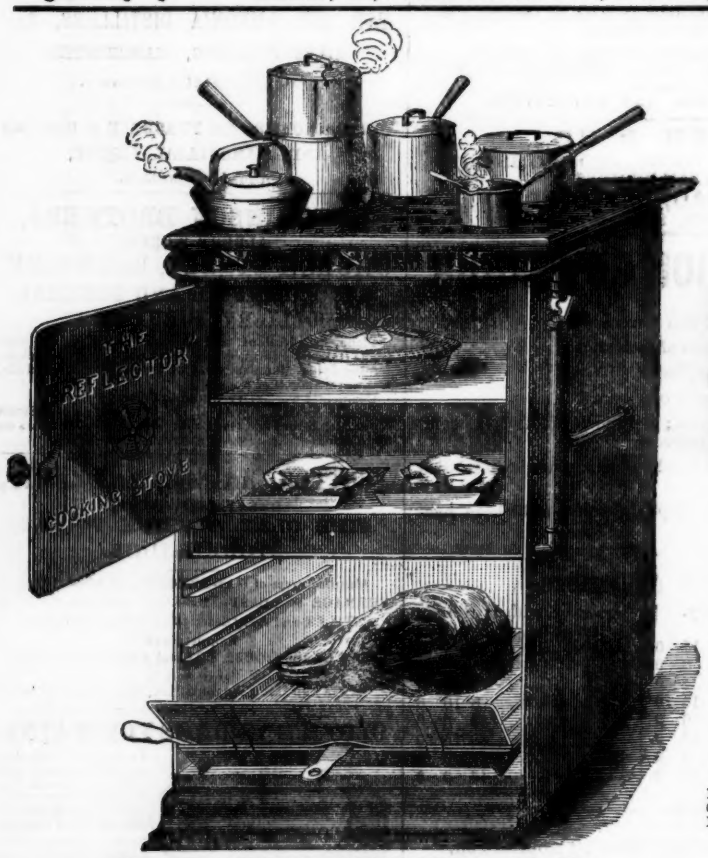
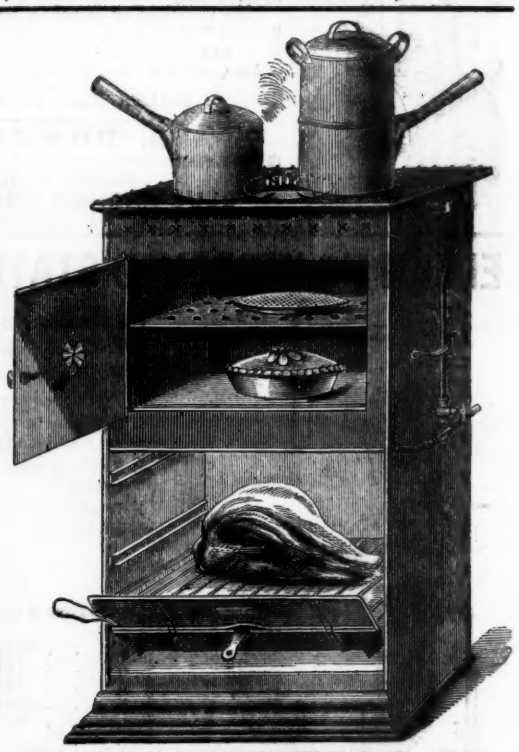


COMPLETE FAMILY GAS COOKING STOVE, No. 135. £5 5s.

Size, 36 in. high, 18 in. wide; Hot-Plate, 22 in. wide × 16 in. deep, with Three Burners for Boiling. If with Bright Rail, 5s. extra. For Roasting, Grilling, Baking, and Boiling. It is fitted with all the latest improvements, capable of cooking a dinner for five to ten persons.



SMALL FAMILY GAS COOKING STOVE, No. 139. £3 10s.

Size, 29 in. high, 15 in. wide, 10 in. deep. Hot-Plate, 16 in. wide and 13 in. deep, with air and gas ring burner. This Stove will Roast a Joint of 6 or 7 lbs., or a couple of Fowls; Grill Chops, Steaks, and Bacon; Toast Bread, Bake Pastry, Rice Puddings, Potatoes, &c., and Boil, Fry, and Stew.

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Warranted to measure correctly, and not to vary.

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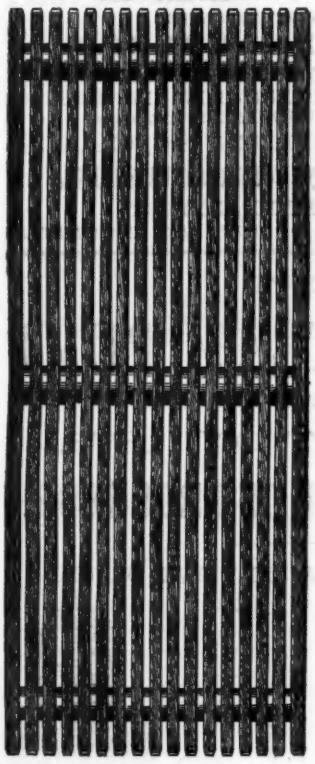

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MADE FROM THE BEST QUALITY

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MADE EITHER TAPER or PARALLEL
WITH SQUARE OR ROUND DISTANCE BLOCKS.

SCALE, ONE-FOURTH FULL SIZE.

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WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

FIRE GOODS, and Salt-Glazed Drain-Pipes.

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Wharf No. 4, inside Great Northern Goods Station, King's Cross, N.;

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WITH TAPER BARS,
MADE BY MACHINERY
CAPABLE OF MAKING 10,000 FEET WEEKLY.
References to Hundreds of First-Class Engineers.
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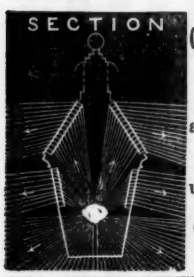

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Is now in use in Moorgate Street, Cheapside, and Trafalgar Square, and has been in successful operation upon Waterloo Bridge since Oct. 7, 1871.
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CAST-IRON GAS AND WATER PIPES.
MALLEABLE IRON TUBE FOR GAS, WATER, AND STEAM.
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CONSUMERS WET & DRY GAS-METERS ON THE MOST APPROVED PRINCIPLES.
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GAS, STEAM, AND WATER FITTINGS.

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MANUFACTURES AND EFFECTS
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GAS EXHAUSTERS,
WITH STEAM-ENGINES COMBINED.
DRY, CENTRE, AND BYE-PASS VALVES; WROUGHT-IRON AND CAST-IRON SCRUBBERS; ANNULAR AND PIPE CONDENSERS, ALL SIZES.
PURIFIERS from 4 to 40 FEET SQUARE.
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RETORT SETTERS & FITTERS SENT TO ALL PARTS.
ALL WORK AND MATERIALS GUARANTEED OF THE BEST DESCRIPTION.

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WAS AWARDED, AT THE
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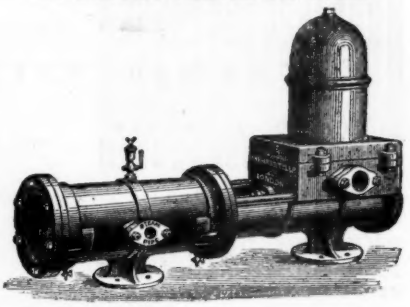

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FOR
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One selected from amongst many Testimonials received by H. T. & Co.:—
"*Ardwick Bridge Chemical Works, Manchester, Oct.* 28, 1872.
"Sir,—The 'Universal' Steam Pump obtained from you, and which has been employed during the last six months pumping caustic soda at these works, still continues working satisfactorily.
"Yours truly,
(Signed) "PETER HART, *Manager.*"

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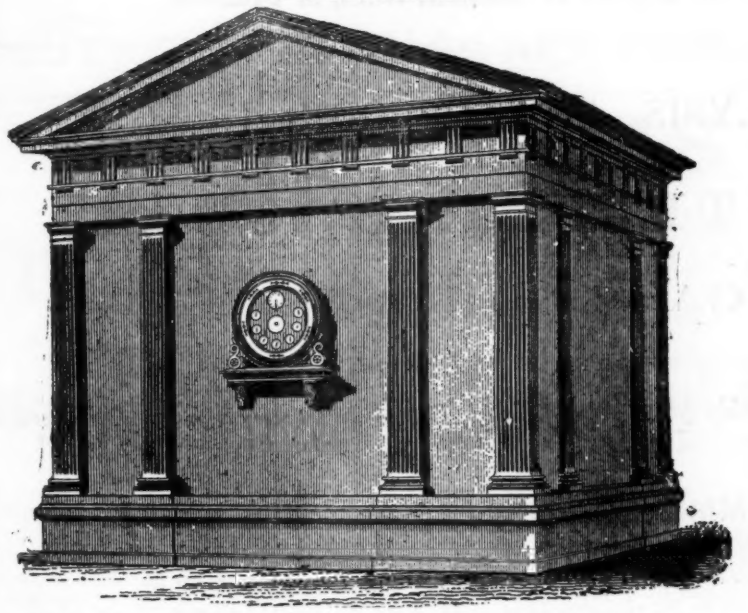

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GAS COOKING APPARATUS.

WATER-METERS SUITABLE FOR ALL PRESSURES.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c., ON APPLICATION.

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Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

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MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.

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RETORT SETTINGS, heated by tar without the production of smoke.

STEAM-ENGINES and EXHAUSTERS, separately or combined.

FOUR-WAY VALVES, one of which is equal to three ordinary Valves.

STATION GOVERNORS—the Gasholder cannot tilt and cause accident.

BREEZE AND TAR FUEL MACHINE.

A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.

N.B.—The second edition of this Work, *now ready*, contains Illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.

"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artizan.*

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COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their

CANNEL FOR GAS-MAKING PURPOSES.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to The Coppa Colliery, Mold, FLINTSHIRE.

THE

HUCKNALL COLLIERY COMPANY

Can offer a CANNEL COAL yielding a large quantity of Gas of superior quality.

Prices and information on application to the HUCKNALL COLLIERY COMPANY, Hucknall Torkard Collieries, near NOTTINGHAM.

POPE & PEARSON'S GAS COAL.—We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near LEEDS.

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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Established 1840.

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COLLIERY PROPRIETORS,

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Supply the Best Wigan Arley Mine Gas Coal and Nuts; the Best Hand-picked Round Cannel;

ALSO SMALL OR GAS CANNEL, &c., &c.

OMOA GAS COAL.

THE OMOA AND CLELAND IRON AND COAL COMPANY, LIMITED,

ARE NOW IN A POSITION TO

SUPPLY FROM THEIR PITS AT OMOA

GAS COAL

OF A VERY SUPERIOR QUALITY.

This Coal, according to the report of the analyst, yields 11,110 cubic feet of gas per ton, and has an illuminating power of 33·97 candles per 5 cubic feet per hour.

Copies of the analysis and full particulars as to price, &c., may be had on application to the SECRETARY of the COMPANY, 172, West George Street, GLASGOW.

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SUPPLIED BY

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Prices Quoted on application.

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WILSONTOWN GAS COAL.

This Coal bears a close resemblance to the Lesmahago seam. It has a first-class Coke, equal to the Lesmahago, and greater in quantity, and 10,538 Cubic Feet of 33·2 Candle Gas.

For rail in Scotland, or shipped at Glasgow, Leith, or Granton.

ANALYSIS AND REPORT

ON

CLIMPY TRIPPING COAL,

FOR GAS PURPOSES.

The results of this analysis, as shown below, were got from actual working, and we have therefore the utmost confidence in placing it, along with that annexed, before you.

COMMERCIAL RESULTS.

Gas per ton of Coal—temperature 60°—barometer 30 inches	10,200 cubic feet.
Coke per ton of Coal	1,400 lbs.
Durability of one cubic foot of the gas, by jet of 5-inch flame	48 min. 24 sec.
Illuminating power in standard candles	14·9

REMARKS.

Being well acquainted with Durham and Northumberland Coals, I have no hesitation in saying that "CLIMPY TRIPPING" is superior to any (containing, besides, a greater proportion of pieces from 7 to 14 lbs. weight), with far less impurities for purification, more gas, and coke equal in calorific power. It has a large mixture of cannel nuts, which accounts for the good quality of the gas, at our photometer in town, 1000 yards from the works.

It is also a very superior Coal for mixing with oils, as by Mackenzie's patent; or with acid tar, or tar oil, shale grease, or other refuse from paraffin-works, as by system of Mr. Scott, of Musselburgh, or Mr. Foster, Portobello, the Coal being easily crushed.

Below are the results realized by myself, when mixed with acid tar from paraffin work, received by me in a solid state, having been run on to very fine dross. My charges were 2 cwt. tripping and 28 lbs. of acid tar, each retort, running six hours; with lighter charges I get more gas, but not so good quality, or so much coke.

Gas per ton of Coal	10,800 cubic feet.
Coke per ton of Coal	1,540 lbs.
Durability of one cubic foot of gas, by jet of 5-inch flame	58 min. 28 sec.
Illuminating power in standard candles	27·29

The first truck received being tried with very light charges (unmixed), and running five hours, I got 10,500 cubic feet of 14-candle gas; and I am confident, practical managers, with good retort-fittings (mine being very inferior), and exhausters at work, as I have seen generally at home and abroad, will take 11,000 feet of 13-candle gas from it. My retorts are 8 feet × 2 feet × 14 inches, D shape, heavy dip, and no exhauster.

These remarks of mine you may perhaps think rather lengthy, but they will be the more intelligible to any manager inquiring for Climpy Tripping.

L. MONK,
Engineer and Manager.

Lanark Gas-Works, April 20, 1874.

GRAY AND PAUL,

WILSONTOWN GAS COAL WORKS & CLIMPY COLLIERY,

BY CARNWATH, N.B.

G. J. EVESON,

GAS COAL MERCHANT,

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Delivery per Rail to any Part.

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MUIRKIRK, No. 1, CANNEL
Yields 11,600 cubic feet of 34·3-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

MUIRKIRK, No. 2, CANNEL
Yields 10,700 cubic feet of 32·77-candle gas per ton, and 9½ cwts. of coke, containing 11 per cent. of ash.

OLD WEMYSS CANNEL
Yields 12,550 cubic feet of 33-candle gas per ton.
Prices and full Analyses on application.

ALBERT GAS COAL.

THE DERBYSHIRE
SILKSTONE COAL COMPANY,
LIMITED,
CAN OFFER A
GAS COAL
Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	10,775
Weight of coke in lbs. per ton of coal	1,465

ANALYSIS AND PRICES ON APPLICATION TO
Mr. EDMUND TAYLOR, Secretary,
ALBERT COLLIERY, NEWBOLD, NEAR CHESTERFIELD.

DUKINFIELD CANNEL COAL.

THE DUNKIRK COAL COMPANY.

OFFICES:

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ANALYSIS, PRICES, AND OTHER INFORMATION, ON APPLICATION AT THE ABOVE OFFICES.

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THORNCLIFFE IRON-WORKS AND COLLIERIES,
NEAR SHEFFIELD,
STRONGLY RECOMMEND A TRIAL OF THEIR
CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

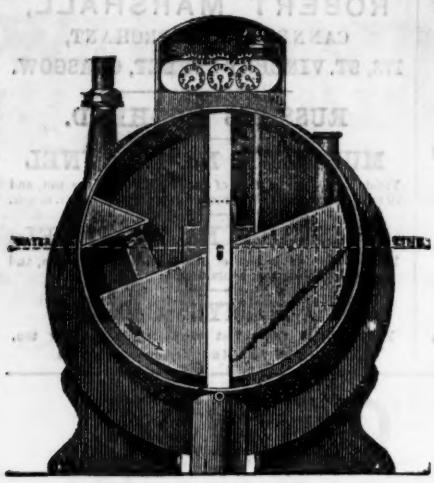
	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.



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Over 90,000 in action.

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"WET" & "DRY" GAS-METERS

of the highest excellence.

STATION-METERS AND GOVERNORS.

STREET-LAMP REGULATORS.

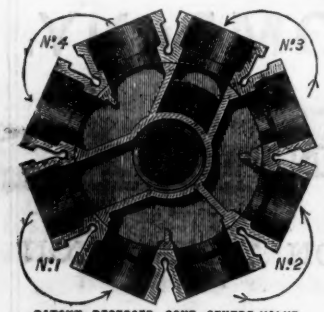
TESTING APPARATUS

of the most perfect description for all purposes relating to Gas.

NOW READY.

"GAS MEASUREMENT AND GAS-METER TESTING," by F. W. HARTLEY, A. Inst. C.E.
Third Edition, cloth boards, 2s.; per post, 2s. 2d.

55 and 55A, MILLBANK STREET, WESTMINSTER, S.W.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Plan.

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EDINBURGH AND GLASGOW,

SOLE MAKERS OF

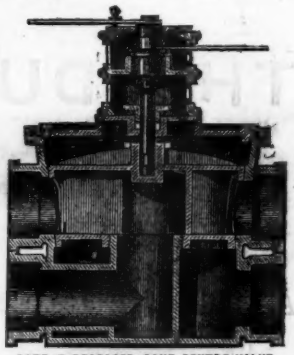
PATENT

RECESSED CONE CENTRE-VALVES,

Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Elevation.

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Invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

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DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;

IMPROVED FULL-WAY CARTER'S VALVES (much approved of);

GAS-STOVES, and every article connected with Gas Apparatus.

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